DOCUMENT RESUME

ED 335 474 CE 058 589

AUTHOR	Nelson, Orville; Lee, Howard
TITLE	VTAE Problem-Solving Workshop (Menomonie, Wisconsin, April 29-May 1, 1991).
INSTITUTION	Wisconsin Univ. - Stout, Menomonie. Center for Vocational, Technical and Adult Education.
SPONS AGENCY	Wisconsin State Board of Vocational, Technical, and Adult Education, Madison.
PUB DATE	Jun 91
CONTRACT	30-101-150-151
NOTE	171p.
PUB TYPE	Collected Works - Conference Proceedings (021) -- Reports - Descriptive (141)
EDRS PRICE	MF01/PC07 Plus Postage.
DESCRIPTORS	Adult Education; Business; Causal Models; Competency Based Education; *Competency Based Teacher Education; Decision Making; *Problem Solving; School Business Relationship; Small Group Instruction; Workshops
IDENTIFIERS	Wisconsin

ABSTRACT

This paper describes a 3-day workshop designed for Wisconsin Vocational, Technical, and Adult Education instructors who taught technical/occupational coursework and focused on problem-solving techniques used in business and industry. Problem-solving techniques were identified through personal and telephone interviews in a sample of 200 training directors in businesses and industries (30% responded). Participants were taught to develop competencies in using common problem-solving techniques, demonstrate competency in using simulation tests of the solutions, and acquire skills in designing follow-up evaluations of problem solutions. (The bulk of this document is composed of four appendices: (1) problem-solving survey results; (2) participant's action plans; (3) workshop materials and handouts; and (4) contact letters. Materials and handouts include information on problem solving and decision making in the printing industry and on small group problem solving, cause-effect diagrams, competency-based learning materials, and Pareto diagrams. Other materials deal with graphic problem-solving techniques, problem solving in business and industry, designed experiments, and evaluation of problem-solving skills. The workshop agenda and 15 references are included.) (NLA)

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ED335474

Final Report

A Project Sponsored by
The Wisconsin Board of VTAE

conducted by

Orville Nelson
Howard Lee
Co-Directors
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UW-Stout

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VTAE Problem-Solving Workshop

June, 1991

CE 058 559

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Project Number: 30-106-150-231

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VTAE Problem-Solving Workshop

Introduction

The VTAE Problem-Solving project's main product was a three-day workshop that focused on problem-solving techniques used in business and industry. The workshop was designed for VTAE instructors who taught technical/occupational coursework. Two instructors from each VTAE district were invited to attend.

To some extent this was a follow-up workshop to the Thinking Skills and Thinking Skills/Coaching Workshops that were offered in 1989 and 1990. The Thinking Skills program was designed primarily for general education instructors in the VTAE System. This workshop presented practical problem-solving techniques used by workers in business and industry. The problem-solving techniques were identified through personal and telephone interviews conducted in a sample of businesses and industries as well as from other research conducted by the Center for Vocational, Technical and Adult Education.

Need

During the last decade, American business and industry has come to realize that it must make a transformation in order to be competitive in the world marketplace. U.S. companies no longer have complete dominance over our marketplace. Products from a variety of foreign companies are competitive on quality and cost basis in our markets. In addition, to be profitable, U.S. companies must become more competitive in the international marketplace.

In order to make this transformation and to become more competitive, U.S. and Wisconsin companies have been making radical changes in their management and production systems. More and more employees are becoming a part of a work team. Work teams are given the responsibility for establishing production schedules, assuring appropriate quality, and producing their product/service in a timely and cost effective manner. To accomplish this, all employees are becoming more involved with decision making and problem solving.

A survey conducted by Center staff members revealed that problem-solving is one of the most common and critical training areas and needs in business and industry in Wisconsin. Figure 1 below presents a summary of the major training areas identified by business and industry in Wisconsin. Problem-solving training was being offered by 83 percent of the respondents.

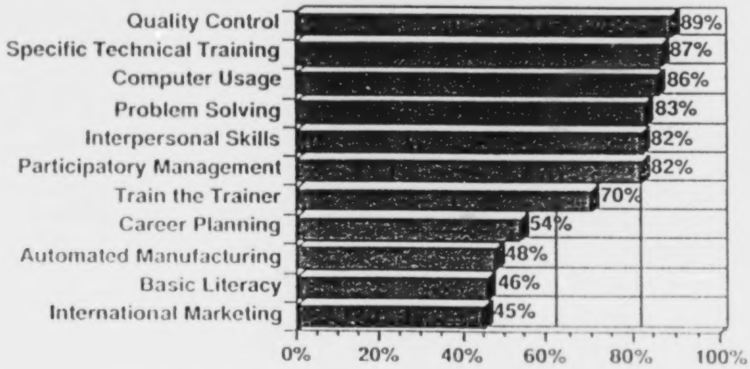

Figure 1: Most common topics for training programs offered by business and industry in Wisconsin

Problem-solving techniques and strategies vary according to the products/services of the company. Determining the specific problem-solving techniques used by business and industry and teaching them to VTAE instructors will have to speed the process of infusing these competencies in vocational and technical curriculums. As a result, VTAE graduates will be better prepared to enter B/I.

Project Objectives

The objectives for the workshop were:

- Prior to the workshop:
  a. Identify typical problem-solving techniques used in business and industry in Wisconsin.
  b. Identify the types of data used in problem solving in business and industry.
- During the workshop the participants will:
  c. Develop competency in using the three most common problem-solving techniques used in business and industry in Wisconsin.
  d. Demonstrate competency in using simulation tests of the solutions in order to evaluate their effectiveness.
  e. Acquire skills in designing follow-up evaluations of problem solutions in order to determine their effectiveness and assess the appropriateness of the problem-solving technique.

Workshop Overview

Content for the workshop was drawn from the problem-solving techniques used in business and industry in Wisconsin. Project staff conducted interviews with people in business and industry to identify common problem-solving techniques used. In addition, a survey of training directors and manufacturing managers was completed. The interviews and the survey also identified the typical types of problems solved and the types of information used. Articles on quality assurance programs were reviewed to identify the types of problem-solving techniques built into these programs. The results of the survey are given in Appendix A.

Information on the workshop was distributed to the instructional service administrators in the sixteen technical college districts in Wisconsin. They were asked to identify three teachers and a alternate in their districts who teach technical/occupational courses to participate in this workshop. After these names were received by the project staff at Stout, the participants reviewed information on the workshop agenda, housing arrangements and time schedules. Participants were asked to bring one or two problems common to their classes and area companies to the workshop.

The workshop used a combination of presentations and hands-on problem-solving activities. Presenters were selected to explain and illustrate the three most common problem-solving techniques used in business and industry in Wisconsin.

After a problem-solving technique had been presented, participants worked in small groups to apply the technique to common types of business/industrial problems. During these application sessions they developed competency in working in small problem-solving teams. The team approach is commonly used in business and industry to solve problems and teachers need to be familiar with how a team functions also.

Participants were introduced to ways they can simulate application of their problem solutions in order to determine their potential effectiveness. The final day included a presentation on evaluation techniques that can be used to follow-up on the effectiveness of the problem solutions developed.

Each participant received a notebook which will include reference copies of the major presentations and provide space to insert the materials they developed during the small group activities.

Workshop Agenda

The workshop agenda follows. The first morning was used to develop concepts and skills used in small group problem-solving situations. This was planned so the participants could use these techniques throughout the remainder of the workshop.

Cause-effect diagrams and analyses were presented, discussed and applied during the afternoon session. Also, participants could register for one course credit for the workshop for the cost of the student activity fee. In order to acquire this credit, the participants had to complete an action plan. The plan required the participants to establish objectives related to the use of the problem-solving techniques in their teaching. They also had to identify the activities they would use to achieve their objectives and give a time table for completing the activities. Twenty-eight of the thirty participants registered for credit. Their action plans are included in Appendix B.

Competency-based learning materials were discussed at the beginning of day two. This was included at this point so the participants could start to develop their action plans. Specific problem-solving techniques, Pareto Diagrams and graphic problem-solving techniques, were discussed next.

During the afternoon session the participants received the results of the problem-solving survey and research. Also, the first portion of the designed experiments presentation was given.

Participants were introduced to the nature of experimentation and were then randomly divided into two groups. Each group received a sample of peanuts to taste and evaluate. Their evaluations were processed on Tuesday evening and the results were discussed on Wednesday morning.

In addition to completing the designed experiments on Wednesday, Howard Lee discussed the action plans and participants were given time to complete them. Also, information on evaluating problem-solving skills was presented.

Copies of materials and handouts used in the workshop are included in Appendix C.

Evaluation

At the end of the workshop participants were asked to complete an evaluation form. The results are given in Table 1. The presentation on small group problem-solving received the highest evaluation with a median response of 4.8 or "very good." The other presentations were given "acceptable" ratings. Several participants commented that the conference presentations did not meet their needs and interests. One cause for this may be that our contact letters to the districts were not specific enough. Some of the participants were not teachers or were not teaching occupational courses. A review of the item analysis for the overall conference evaluation (16) disclosed that 38 percent thought that the conference was "poor," another 38 percent thought that it was "good" or "very good," and 24 percent indicated that it was "acceptable."

PROBLEM-SOLVING WORKSHOP AGENDA

MONDAY, APRIL 29TH

8:00 — 8:30	Registration and Coffee
8:30 — 8:35	Welcome and Overview of Workshop - Orv Nelson
8:35 —10:15	Small Group Problem Solving - Charlie Krueger
10:15 —10:30	Break and Discussion
10:30 —12:00	Small Group Problem Solving - Charlie Krueger
12:00 — 1:00	Lunch
1:00 — 1:30	Register for Course Credit - Orv Nelson
1:30 — 2:30	Cause-Effect Diagrams - Dick Nickel
2:30 — 2:45	Break and Discussion
2:30 — 4:15	Cause-Effect Diagrams - Dick Nickel
4:15 — 4:30	Summary and Overview
4:30	Adjourn

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Menomonie
Wisconsin

PROBLEM-SOLVING WORKSHOP AGENDA

TUESDAY, APRIL 30TH

8:15 — 8:25	Overview the Day
8:25 — 9:30	Competency-Based Learning Materials - Howard Lee
9:30 —10:00	Pareto Diagrams - Orv Nelson
10:00— 10:15	Break and Discussion
10:15 —11:00	Pareto Activity
11:00 —12:00	Graphic Problem-Solving Techniques - Orv Nelson
12:00 — 1:00	Lunch
1:00 — 2:00	Problem Solving in Business and Industry • Growing Importance • Problem-Solving Process - A Framework • Creativity and Problem Solving
2:00 — 2:30	Designed Experiments - Orv Nelson
2:30 — 2:45	Break and Discussion
2:45 — 3:30	Designed Experiments - Continued
3:30 — 4:20	Small Group Discussion - Problems for Students
4:20 — 4:30	Tomorrow's Activities
4:30	Adjourn

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PROBLEM-SOLVING WORKSHOP AGENDA

WEDNESDAY, MAY 1ST

8:15 — 8:20	Overview the Day
8:20 — 9:00	Action Plans - Howard Lee
9:00 —10:00	Small Group Sessions by Discipline • Discuss Problems That Students Could Solve • Discuss Approaches That Could be Used to Integrate Problem Solving in Courses
10:00 —10:15	Break and Discussion
10:15 —10:30	Designed Experiments: Analysis of Results - Orv Nelson
10:30 —11:45	Participants Develop Action Plans
11:45 —12:00	Hand in Action Plans and Evaluate Workshop
12:00	Adjourn *

** Those who want to enroll for independent study during the summer should see Howard Lee or Orville Nelson if they have any questions.*

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Table 1

VTAE Problem-Solving Evaluation Results

Characteristics of the Workshop	Results	
	Median	IQR
1. Small Group Problem-Solving Presentation.	4.8#	.9@
2. Cause and Effect Diagram.	3.2	1.2
3. Competency-Based Learning Materials	3.0	.9
4. Pareto Diagrams	3.0	1.5
5. Systems Analysis	2.8	1.2
6. Problem Solving in Business and Industry.	2.9	1.2
7. Designed Experiments	2.9	1.5
8. Developing An Action Plan..	3.2	1.6
9. Evaluating Problem-Solving Competencies.	2.7	1.9
10. Small Group/Planning Session-Wednesday.	3.2	1.1
11. Workshop Facilities	4.6	1.1
12. Snacks/Coffee Breaks.	4.2	1.5
13. Noon Lunches.	4.7	1.1
14. Audiovisual Materials.	3.2	1.7
15. Conference Agenda.	3.1	1.7
16. Overall Evaluation of the Conference	3.0	1.7

# Statistics are based on the following scale:

1=VP=Very Poor
2= P=Poor
3= A=Acceptable
4= G=Good
5=VG=Very Good

@ The IQR is equal to Third Quartile-First Quartile

If this workshop is to be repeated in the future, a more precise job must be done in targeting the audience and selecting the participants. Also, the presentations, with the exception of small group problem-solving, need to be carefully reviewed and refined.

Problem-Solving Workshop

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Appendix A

Problem-Solving Survey Results

CVTAE
CENTER FOR VOCATIONAL, TECHNICAL AND ADULT EDUCATION
715-232-1382

UNIVERSITY OF WISCONSIN
STOUT
MENOMONIE WISCONSIN 54751

February 11, 1991

Dear Training Director/Human Resource Development Manager:

You can provide important assistance that will help improve vocational and technical education in our schools and has the potential to pay long-term benefits to your company. The information you will provide on problem-solving in the enclosed survey will be of immediate assistance to us in planning a workshop for instructors in the Wisconsin VTAE System. These VTAE instructors in turn will use the problem-solving processes and techniques acquired through this workshop to improve their courses and instruction. As a result, their students will be better problem-solvers and more productive employees in businesses and industries in the region.

Our recent evaluation and research studies have indicated a growing need for effective problem-solving skills in business and industry. The implementation of quality programs, new management techniques, and work teams require a more comprehensive set of problem-solving competencies. The enclosed survey was designed to identify the problem-solving techniques used in business and industry. This information will be used to design the agenda for our workshop for VTAE teachers.

You should be able to complete the enclosed survey in five to ten minutes. The survey lists several processes and techniques used in problem-solving. Based on the information currently available to you, identify whether these techniques are used in your company and provide information on their applications. You do not need to do any special survey or information gathering in order to respond. There is space at the end of the survey to list additional problem-solving techniques/processes used in your company. Also, if you have resource people and/or materials you would like to recommend for use in the problem-solving workshop, we would appreciate receiving information on them. Include this information with the survey when you return it in the business reply envelope.

Two extra copies of the survey are enclosed. If it is possible, we would like to have you give these to two of your first-line supervisors or managers. They should complete the survey based on the problem-solving techniques they use in their work. Please return your survey in the enclosed business reply envelope.

Your assistance with this survey is really appreciated. The information you provide will be used to select the techniques that will be discussed in our problem-solving workshop.

Sincerely yours,

Orville Nelson

Orville Nelson, Co-Director
Center for Vocational, Technical
and Adult Education
UW-Stout
218 Applied Arts Bldg.
Menomonie, WI 54751
(715) 232-1382

Howard Lee

Howard Lee, Co-Director
Center for Vocational, Technical
and Adult Education
(715) 232-1251

jb

Enclosures

P.S. If you would to have a summary of the results from this survey, give your name and address at the end of the survey instrument. We will forward a summary to you as soon as it has been completed.

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CVTAE
CENTER FOR VOCATIONAL, TECHNICAL AND ADULT EDUCATION
715-232-1382

UNIVERSITY OF WISCONSIN
STOUT
MENOMONIE WISCONSIN 54751

February 11, 1991

Dear Manager:

You can provide important assistance that will help improve vocational and technical education in our schools and has the potential to pay long-term benefits to your company. The information you will provide on problem-solving in the enclosed survey will be of immediate assistance to us in planning a workshop for instructors in the Wisconsin VTAE System. These VTAE instructors in turn will use the problem-solving processes and techniques acquired through this workshop to improve their courses and instruction. As a result, their students will be better problem-solvers and more productive employees in businesses and industries in the region.

Our recent evaluation and research studies have indicated a growing need for effective problem-solving skills in business and industry. The implementation of quality programs, new management techniques, and work teams require a more comprehensive set of problem-solving competencies. The enclosed survey was designed to identify the problem-solving techniques used in business and industry. This information will be used to design the agenda for our workshop for VTAE teachers.

You should be able to complete the enclosed survey in five to ten minutes. The survey lists several processes and techniques used in problem-solving. Identify if you use these techniques and provide information on their applications. You do not need to do any special survey or information gathering in order to respond. There is space at the end of the survey to list additional problem-solving techniques/processes you use. Also, if you have resource people and/or materials you would like to recommend for use in the problem-solving workshop, we would appreciate receiving information on them. Include this information with the survey when you return it in the business reply envelope.

Your assistance with this survey is really appreciated. The information you provide will be used to select the techniques that will be discussed in our problem-solving workshop.

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Orville Nelson

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Problem-Solving Techniques Survey

The table below presents a list of several problem-solving techniques and processes. Review each one and respond in columns A, B, and C. In Column A, identify how frequently the technique is used in your company. Use the responses listed below. In Column B, indicate if any training for the technique has been done in your company. In Column C, indicate if the technique is used to solve daily and emergency problems (D), and/or develop long-term solutions and plans (L). In Column C, you may select either or both responses.

1= NO=Not Used	4= U=Usually
2= S=Sometimes Used	5=AL=Always
3= O=Often	

•Circle Your Anwers		A					B		C	
	Problem-Solving Techniques/Processes	How Often Is This Technique Used?					Has Training Been Done? Y=Yes N=No		How Is This Technique Used? D= Daily & Emergency Problem Solving L=Long-Term Solutions And Planning (Circle all that apply)	
		NO 1	S 2	O 3	U 4	AL 5				
1-3.	Cause-Effective Diagram .... (Fishbone Charts)	1	2	3	4	5	Y	N	D	L
4-6.	Check Sheets	1	2	3	4	5	Y	N	D	L
7-9.	Concept/Perceptual Mapping.	1	2	3	4	5	Y	N	D	L
10-12.	Consensus Decision-Making. (Group Problem-Solving)	1	2	3	4	5	Y	N	D	L
13-15.	Creativity Techniques	1	2	3	4	5	Y	N	D	L
16-18.	Critical Incidents..................	1	2	3	4	5	Y	N	D	L
19-21.	Designed Experiments...........	1	2	3	4	5	Y	N	D	L
22-24.	Flow Charts........................	1	2	3	4	5	Y	N	D	L
25-27.	Graphic Problem-Solving...... Techniques	1	2	3	4	5	Y	N	D	L
28-30.	Hypothesis Testing	1	2	3	4	5	Y	N	D	L
31-33.	Logic and Reasoning Skills. ..	1	2	3	4	5	Y	N	D	L
34-36.	Models (Graphic, Math, etc.).	1	2	3	4	5	Y	N	D	L
37-39.	Pareto Diagrams	1	2	3	4	5	Y	N	D	L
40-42.	Problem Analysis Techniques.	1	2	3	4	5	Y	N	D	L
43-45.	Scientific Method.................	1	2	3	4	5	Y	N	D	L
46-48.	Systems Analysis	1	2	3	4	5	Y	N	D	L

-Over-

•Circle Your Anwers		A	B	C
Problem-Solving Techniques/Processes		How Often Is This Technique Used? NO S O U AL 1 2 3 4 5	Has Training Been Done? Y=Yes N=No	How Is This Technique Used? D= Daily & Emergency Problem Solving L=Long-Term Solutions And Planning (Circle all that apply)
49-51.	Simulation.	1 2 3 4 5	Y N	D L
52-54.	Scatter Diagrams.................	1 2 3 4 5	Y N	D L
55-57.	Tree Diagrams.....................	1 2 3 4 5	Y N	D L
58-60.	Other ____________________	1 2 3 4 5	Y N	D L
61-63.	Other ____________________	1 2 3 4 5	Y N	D L
64-66.	Other ____________________	1 2 3 4 5	Y N	D L

67. What is the size of your company?

________1. 25 or Less Employees
________2. 26-50
________3. 51-100
________4. 101-500
________5. 501 or More Employees

68. Which of the following best describes your work?

________1. Training/Human Resource Department
________2. Manufacturing
________3. Design/Product Development
________4. Marketing
________5. Financial
________6. President/V.P.
________7. Other ____________

69. Would you like to recommend presenters/resource persons to present on one or more of these techniques? If yes, please list their name, address and phone number below.

________1. Yes Name: ______________________________
Address: ______________________________
____
Phone #: ______________________________
________2. No

If you would like to have a summary of the survey results, give your name and address below.

Name: ______________________________
Address: ______________________________
____

Thank you for responding.

Please return to:
Orville Nelson
CVTAE/UW-Stout
218 Applied Arts Building
Menomonie, WI 54751

Problem Solving Survey

Purpose

The purpose of the survey was to identify the types of problem-solving techniques used in business and industry. Project staff members had reviewed literature and interviewed people in business and industry to identify problem-solving techniques that were being employed. The mail survey was conducted to determine the relative frequency each was used.

Training directors and supervisors of manufacturing were selected as the populations for the survey. Training directors work with a variety of individuals and in various types of companies. Thus, it was concluded that they would have a broad perspective and knowledge of the types of problem-solving techniques used. Supervisors of manufacturing operations were selected to provide information on the types of problem-solving techniques used in this sector of Wisconsin's economy. The sample of training directors was selected from the membership roster in the Southern Minnesota, Northern Wisconsin, and Milwaukee Chapters of the American Society of Training Directors. The sample of training directors included 200 people. Surveys were sent to manufacturing supervisors by asking the training directors to distribute copies of the survey to manufacturing directors in their companies. Two extra copies of the survey were enclosed with the training director's survey. Slightly more than 30 percent responded. This response rate is typical of this type of survey; however, it is low. The results were contrasted with the interview results and findings from two similar studies done by CVTAE staff. The high level of argument between the results of these studies suggested that the results from this survey were valid.

The survey instrument was designed to obtain information on the extent to which selected problem-solving techniques were used, whether training had been done, and the type of planning in which the technique was used. A copy of the survey is attached. The problem-solving techniques were given in the left-hand column and the respondents were then asked to provide three responses to each technique. They did this by circling the number or the letter that reflected their response. There was space at the end of the list of problem-solving techniques for respondents to add additional techniques. Approximately ten percent of the respondents did this. Respondents were also asked to include their role in their companies and the size of their company.

The people responding were not given definitions of each of the problem-solving techniques. Project staff were concerned that too large a volume of material with the survey would discourage responding. Also, if respondents were using the technique they would not need the definition. This still leaves the possibility that some people may have been using a technique, but were associating it with a different name. To counter this, common names were used for the problem-solving techniques. Also, additional information was included in parentheses after the name of the technique if there was a possibility of some confusion. In addition, respondents could list other techniques at the end of the survey.

To encourage response, participants were invited to give their name and address if they were interested in the results. Many of those who responded did give their names and addresses.

The survey was conducted during February and March, 1991.

The most frequently used problem-solving techniques were:

- Consensus Decision-Making
- Check sheets
- Logic and Reasoning Skills
- Flow Charts
- Problem Analysis Techniques
- Systems Analysis
- Creativity

Training was most likely to have been provided for:

- Consensus Decision-Making
- Flow Charts
- Cause-Effect Diagrams
- Check Sheets
- Pareto Diagrams
- Problem Analysis Techniques

A majority of the respondents use the following techniques for short-term (daily) planning:

- Consensus Decision-Making
- Check Sheets
- Problem Analysis Techniques
- Flow Charts
- Logic and Reasoning Skills

The long-term planning techniques identified by a majority of the respondents were:

- Consensus Decision-Making
- Flow Charts
- Problem Analysis Techniques

Consensus decision-making, flow charts and problem analysis techniques were included in all four areas. This indicated frequent use, high levels of training provided and application to short- and long-term planning.

Designed experiments were not used frequently, nor had extensive training been done in the area. Our interviews, contacts with industry, and review of literature indicate that this topic is likely to grow in importance. Thus, it was included in the conference agenda.

TABLE 1
PROBLEM-SOLVING TECHNIQUES USED
IN BUSINESS/INDUSTRY

Problem-Solving Techniques/ Processes N=58	How Often is This Technique Used?		Has Training Been Done?		How is This Technique Used?		
	MEAN @	s	YES #	NO #	DAILY +	LONG TERM +	OMIT +
1. Cause-Effect Diagram......... (Fishbone Charts)	1.9	1.0	47	38	31	47	45
2. Check Sheets.................	2.9	1.2	47	36	67	36	26
3. Concept/Perceptual Mapping...	1.6	1.1	12	59	9	19	79
4. Consensus Decision-Making.... (Group Problem-Solving)	3.5	1.0	60	33	72	79	9
5. Creativity Techniques........	2.2	1.2	28	47	29	43	50
6. Critical Incidents...........	1.7	1.0	14	52	24	16	67
7. Designed Experiments.........	1.6	.7	24	48	10	33	64
8. Flow Charts..................	2.8	1.3	57	33	53	64	24
9. Graphic Problem-Solving Techniques..................	2.0	1.2	28	41	31	36	60
10. Hypothesis Testing...........	1.6	.9	10	57	19	28	69
11. Logic and Reasoning Skills...	2.9	1.5	19	64	53	43	40
12. Models (Graphic, Math, etc.).	1.9	1.0	26	45	17	36	62
13. Pareto Diagrams.............	2.1	1.3	45	34	36	40	52
14. Problem Analysis Techniques..	2.5	1.2	43	43	57	52	31
15. Scientific Method...........	2.0	1.3	28	41	34	26	62
16. Systems Analysis............	2.3	1.2	33	52	41	48	45
17. Simulation..................	1.9	1.1	17	52	16	28	66
18. Scatter Diagrams............	1.6	.9	33	33	19	19	71
19. Tree Diagrams...............	1.5	.7	21	45	12	24	72
20. Other.......................	10 additional techniques were listed. • Force Field Analysis • Priority Analysis • Computer Simulation • Control Charts • Mind Mapping • Asset Teams • Brainstorming						

@ Mean and standard deviation (s) are based on the following scale:

1= NO=Not Used
2= S=Sometimes Used
3= O=Often
4= U=Usually
5= AL=Always

#Percentages. The percentages do not total 100% because of omits.

+Percentage. Multiple responses cause totals to be more than 100%.

TABLE 2
SIZE OF COMPANY

NUMBER OF EMPLOYEES	N	%
25 or less	10	17
26-50	3	5
51-100	5	9
101-500	8	14
501 or more	32	55
TOTAL	58	100

TABLE 3
RESPONDENT'S RESPONSIBILITIES

RESPONSIBILITIES	N	%
Training/Human Resource Development	29	50
Manufacturing	13	22
Design/Product Development	4	7
Marketing	2	3
Financial	0	0
President/Vice President	4	7
Other	14	24

NOTE: Several respondents selected more than one response.

Appendix B

Participant's Action Plans

VTAE PROBLEM-SOLVING WORKSHOP
Name ______________________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:

   To implement the problem-solving techniques presented to determine why enrollments are decreasing in Fashion Merchandising programs throughout the VTAE system, specifically at CVTC.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
To determine what lead to UW-Stout's decision to change their Fashion Merchandising program to Retail Management. What information assisted their department in the decision making process? How and from whom was data collected?	Interview Wray Lamb, Program Director of the former Fashion Merchandising program and the current Retail Management Problem.	By June 10, 1991.
To design and distribute with the assistance of the four other members of our Marketing Department, survey instruments to: - Advisory Committee members. - Past, current, potential employees. - Past, current, potential students. - Guidance counselors. - Other schools who have already made the change. These key groups have already been identified through brainstorming and open-ended questioning.	- Distribute surveys. - Collect data. - Analyze data. - State conclusions.	By June 30, 1991.
To assume the role of "task leader."	Concentrate on the content of the problem (Charlie Krueger referred to as the "nuts and bolts.") Develop the most and determine the best ideas for solving the problem.	

VTAE PROBLEM-SOLVING WORKSHOP
Name ______________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:

   Awareness - receptivity to later requests for help in developing curriculum for help in problem-solving concepts/processes.

2. How do you plan to accomplish the goal?

   Objective(s) Action Timeline

   This depends on how staff requires assistance. Will be on-going collecting process of searching, researching, supporting materials. Making Professional Development Center depository of resources.

VTAE PROBLEM-SOLVING WORKSHOP
Name ______________________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:

   Create a module for use in Social Science classes emphasizing problem-solving approach to business and social issues.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
I. Incorporate new techniques of problem solving into critical thinking unit on problem solving thereby creating a new module ready for Fall '91.	Write module curriculum including existing materials, media	Fall '91.
II. Survey local businesses on problem-solving techniques used in order to incorporate these ideas into module.	Survey in progress	Fall '91.

VTAE PROBLEM-SOLVING WORKSHOP
Name ____________________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:

   I will present a brief overview of the workshop to all electronic core instructors at LTC. and use the small group problem-solving process with the instructor to determine how we can implement a formal unit into one of the core courses.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Identify problem-solving steps and actions.	Present at core electronic meeting.	May 9.
Discuss problem-solving methods.	Present at core electronic meeting.	May 9.
Implement a formal instructional unit on problem-solving core course.	Use small group problem solving with instructors to determine where and what on problem solving should be implemented.	Between May and start of fall term.

VTAE PROBLEM-SOLVING WORKSHOP
Name ______ __ _______________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:
   Reinforce students information concerning accident prevention. Use cause and effect techniques in troubleshooting.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
1. Student will identify accidents as listed in government publications.	Review publications.	20 to 30 minutes.
2. Student will identify the most common accidents.	Develop pareto diagram.	30 to 40 minutes.
3. Students will determine possible causes of identified accidents.	Use of cause/effect diagram in groups of 4 or 5.	30 minutes.
4. Students compare causes identified to causes listed in publications.	Comparison of possible cause to known cause.	20 minutes.
5. Reinforce what has been learned about accident prevention.	Compare causes to class notes and textbook.	
6. New solutions.	Identify solutions not mentioned in notes or textbook.	

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1. Troubleshoot a mechanical problem.	Use cause and effect diagram.	Variable.

VTAE PROBLEM-SOLVING WORKSHOP
Name ____________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:

   A. Share information gained with our Dean, and utilize problem-solving techniques within our department and divisional meetings.
   B. Integrate problem solving into my curriculum.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Identify problems that can then be solved within both department and division.	Share problem-solving techniques with my colleges.	Fall 1991.
Teach problem-solving techniques to my students.	Analyze areas to implement problem solving within the curriculum. Develop curriculum.	Fall 1991.

VTAE PROBLEM-SOLVING WORKSHOP
Name ____________________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:

   Would like to become more aware of creative and critical thinking problems students experience when problem solving. Would like to develop the ability to evaluate students' abilities in this area which is crucial to the areas I teach in. (electronics/ computers)

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Adapt an existing evaluation instrument for administering on-line.	Plan and write software.	150 - 250 hours.
Use source code for above as a case study of problem solving.	Develop a unit which deals with problem definition, flow charting and program planning.	50 hours.

VTAE PROBLEM-SOLVING WORKSHOP
Name ____________________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:

   Reinforce materials and compliment our program 2 credit course in problem solving and decision making for the supervisor's management program. I will also be working with business and industry and develop a problem-solving component for their consideration.

2. How do you plan to accomplish the goal?

   Objective(s) Action Timeline

   1. I will be offering the (2) credit problem-solving course in the spring semester of 1992. I will implement the following components along with others at this time.
      A. Small group problem solving.
         - Instruction.
         - Group activities.
      B. Cause-effect diagrams.
      C. Pareto diagrams.
      D. Flow charts.
      E. Systems analysis.

   2. Develop a component of problem solving for business and industry. I will be working with the Zengler-Miller problem-solving materials; therefore, I will work closely with business leaders to assure we develop the components they will use most frequently.

VTAE PROBLEM-SOLVING WORKSHOP
Name ____ ______________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:
   Future work with Quality Transformation Team and more immediate sharing with Tech Prep Team.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Implement problem-solving skills in meetings.	Share concepts and resources with Tech Prep Team members who teach in courses which lead themselves to use of these skills.	As opportunities present themselves.
Promote the use of problem-solving skills in classroom situations.	Share and discuss resources and concepts with Quality Transformation Team.	

VTAE PROBLEM-SOLVING WORKSHOP
Name ______________________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:
   To incorporate new knowledge (ideas) into our problem-solving units in Applied Human Relations and Oral/Interpersonal Communication.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
To share ideas with other instructors teaching the courses.	Call a meeting during inservice.	May inservice.
Include activities in problem-solving units.	Rewrite the curriculum for those units.	To be in place in fall of 1992.

VTAE PROBLEM-SOLVING WORKSHOP
Name ______________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:

   Develop a math problem-solving mini module for use in Tech Math II and/or the Math Lab. concerns; identifing the givens in a math story problems.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Identify variables. (independent) (dependent) (extraneous)	Orgainize. (Fish chart) (Cause -effect)	By Jan 1992.

Do not operate in a "data free" environment.

VTAE PROBLEM-SOLVING WORKSHOP
Name ______________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:
   Incorporate teaching some problem-solving techniques for decision making in emergency care situation, within the Emergency Care for Health Occupations Course.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Tentatively identify unit/s where problem solving could be used.	Analyze course materials to find where the problem-solving approach would be helpful.	By June 1.
Coordinate for all sections.	Consult with 2 other instructors to explore purpose for project.	By May 28.
	Assemble view-points/ideas.	By June 6.
	Discuss 1 section vs all.	By June 6.
	Concensus on how to proceed.	By June 6.
Decide on problem-solving tehniques to incorporate.	Analyze selected unit/s. Necessary data gathering. Determine activities for the classroom. (Integration)	By August 15.

VTAE PROBLEM-SOLVING WORKSHOP
Name ______________________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:
   Evaluate present Business Decision Making course to ensure curriculum contains principles set forth in the workshop.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Review curriculum content for:	1. Decision making process. 2. Use of tools: pareto charts, fish-bone charts, etc. 3. Small group facilitation skills development.	

Will be completed prior to the Fall semester or the next course offering.

VTAE PROBLEM-SOLVING WORKSHOP
Name ____________________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:
Implement problem-solving terms and techniques in the Production Phase of the Production Printing Program.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
List the problem-solving steps and actions.	Develop a module of instruction.	By the end of May.
Discuss methods of problem solving. (i.e. critical thinking fish charts pareto diagram designed experiments)	Develop a module of instruction.	End of May.
Design specific methods and areas of student use for problem-solving methods. (i.e. production meetings lab projects)	Develop a lab module of instruction.	End of May.
Rewrite a rating scale to measure student problem-solving skills.	Develop a rating scale.	

VTAE PROBLEM-SOLVING WORKSHOP
Name ______________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:

   I plan on incorporating a problem-solving module into my course of instruction.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Students will learn different problem-solving techniques.	I will develop work sheets and other instructional aids.	By June 1991.
Students will practice problem-solving techniques while in a job like situation.	I willl present them with real problems that are actually occurring in our shop. Then use their problem-solving skills to correct the problem.	This will be used Fall Semester 1991.
I will give students a post problem-solving unit test on terms and guidelines of problem solving.	Develop test.	Fall Semester 1991.

VTAE PROBLEM-SOLVING WORKSHOP
Name ______________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:
   Be able to teach problem solving to my Diesel and Heavy Equipment students.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Diesel and Heavy Equipment students learn problem solving.	Begin teaching problem-solving techniques to our Diesel and Heavy Equipment students.	2nd semester 1991-92 school year.
Update curriculum in Diesel Shop Operations course.	Write and improve current curriculum to include problem solving.	Summer 1991.

VTAE PROBLEM-SOLVING WORKSHOP
Name ____________________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:
   Develop and implement a problem-solving module for use in the Small Business Management program at N.T.C.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Identify specific course to insert module on problem solving.	Review program courses.	May 15, 1991.
Develop module for implementation.	Write module study guide using resources and tools learned in workshop.	Summer 1991.
Implement module.	Insert into course.	Fall 1991.

VTAE PROBLEM-SOLVING WORKSHOP
Name ____________________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:

   Develop an 18 hour, 1 credit competency-based seminar curriculum utilizing selected models from the VTAE Problem-Solving Workshop.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Identify competencies.	Review of Selected Literature from workshop and other sources.	
Write competency statements.		May 31, 1991.

VTAE PROBLEM-SOLVING WORKSHOP
Name ____________________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:

   Share information received with our Division Dean with the intention of implementing problem-solving techniques at both the divison level and department level.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
To be able to identify problems and to use various techniques to solve them.	Share problem-solving techniques.	Fall semester 1991.
Increase awareness in co-workers of various problem-solving techniques.	Group discussion on methods of problem solving.	

VTAE PROBLEM-SOLVING WORKSHOP

Name ______________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:
   Develop a seminar/workshop/class on problem-solving/quality-improvement tools.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Compile a list of problem-solving formats.	Research of literature. Personal contacts.	Indeterminant.
Compile survey of tools business uses.	Identify population. Develop instrument. Administer. Analysis.	Indeterminant.
Define content of seminar.	Write the seminar. Develop the binder. Plan the examples. Reading list.	Indeterminant.
Administration.	Schedule seminar class. Test binder with quality improvement students. Logistics: Production. Advertisements/promotion.	Indeterminant.

VTAE PROBLEM-SOLVING WORKSHOP
Name ____________________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:

   In order to instruct and influence my students I need to have a through understanding myself. To reinforce the concepts I learned in this class by teaching it to others.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
	Share with SM Team.	May 3.
	Share with problem-solving class.	May 2nd.
	Integrate into problem-solving curriculum.	During summer 1991.
Develop critical thinking skills in all classes.	Ask open ended questions which lead students through a problem-solving process.	Ongoing.

VTAE PROBLEM-SOLVING WORKSHOP
Name ____________________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:
Implement the problem-solving techniques into current curriculum for food service management students.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Student will be able to identify the steps in problem solving and apply with 90% accuracy.	Develop case study that will implement the following techniques: • Problem identification - data analysis. • Pareto. • Fish bone - probable cause. • Small group discussion. • Brainstorming. • Weighted average.	Fall 1991.

VTAE PROBLEM-SOLVING WORKSHOP
Name ____________________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:

   Blend some of the problem-solving techniques into present hospitality sales/ marketing course.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
The student will be able to identify and apply several problem-solving techniques.	Create a case study/module that will require the use of the following problem-solving techniques. • Problem identification. • Data analysis. • Small group problem-solving techniques. • Brainstorming - weighted analysis. • Fish chart.	Fall 1991.

VTAE PROBLEM-SOLVING WORKSHOP
Name ____________________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:
   To incorporate better problem-solving techniques to arrive at decisions within my department concerning equipment and curriculum changes.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Use cause and effect diagrams to determine equipment needs in my department.	Encourage this type of approach before major decisions are made concerning equipment changes.	1991-92 school year.
Use cause and effect diagrams to analyze curriculum needs.	Cause and effect diagrams or pareto diagrams should be used to determine curriculum needs and changes.	1991-92 school year.
Could also incorporate a problem-solving unit or activity in my Professional Development courses.		Fall 1991.
Integrate problem-solving techniques in updating the curriculum in the courses I teach, especially in the computer areas.		1991-92 school year.

VTAE PROBLEM-SOLVING WORKSHOP
Name ______________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:

   To facilitate the planning of and effectively implement new Computer Assisted Instruction Lab for CVTC faculty and staff. Use problem-solving techniques to overcome fear of change, determine current needs, and encourage discussion amongst staff.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Define purpose of lab.	Committee-problem-solving group dynamics.	Ongoing, spring 1991.
Evaluate available authoring systems.	Systems analysis.	Ongoing, spring 1991.
Determine what CVTC currently has for software/equipment.		Ongoing, spring 1991.
Select 3-6 initial projects with their associated faculty/staff.	Module development.	1991-92.

VTAE PROBLEM-SOLVING WORKSHOP
Name ______________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:

   Blend problem-solving technique into present hospitality marketing curriculum to replace current introductory material.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
The student will be able to identify and apply with accuracy, the steps required to implement problem-solving techniques.	Create a case study that will require the use of the following skills: A) Problem identification. B) Small group problem solving. C) Brainstorm to develop fish-bone chart. D) Use weighted analysis to determine probable cause. E) Repeat C using probable cause identified. F) Repeat D. G) Brainstorm to develop possible solutions.	Fall 1991.

VTAE PROBLEM-SOLVING WORKSHOP
Name ____________________________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:
   Is to share the information with the Tech Prep Team and discuss ideas for implementation/integration into next year's project.

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Share problem-solving concepts with Tech Prep Team.	Hold informational meeting.	Wednesday May 1, 1991. 2:30 PM meeting. Tech PrepTeam . Room 501.
Construct a list of ideas for implementation/ integration.	Brainstorm ideas for implementation/ integration into next year's project.	

VTAE PROBLEM-SOLVING WORKSHOP
Name ______ ____ __________

ACTION PLAN

Identify how you plan to utilize what you have learned in Problem-Solving Workshop.

1. Your main goal for using what you learned in the workshop:
   Integrate problem-solving techniques into a Police Science course related to "Community Oriented Policing."

2. How do you plan to accomplish the goal?

Objective(s)	Action	Timeline
Develop a policing problem-solving module that identifies problem solving tools: A) Effective group interaction skills in problem solving. B) Cause and effect fish-bone diagram analysis techniques.	Student projects will be required to incorporate these problem-solving technieques in: A) Group classroom problem analysis assignments. B) Research persuasive papers identifying current issues in law enforcement that integrates problem-solving analysis techniques.	June 1, 1991 to August 1, 1991.
Integrate these problem-solving techniques into a curriculum guide on issues in law enforcement course (Community Oriented Policing) by providing case studies which simulate policing problems and issues; identifying information related to actual and perceived community crime and disorder data that is affected by population, environment, economics, and politics in various settings - urban, urban/rural and rural communities.		

Appendix C

May 29, 1991

Problem Solving and Decision Making Strategies

in the Printing Industry

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LAKESHORE
TECHNICAL COLLEGE

Problem Solving and Decision Making Strategies

in the Printing Industry

DESCRIPTION

The people working in the printing industry are typical of workers in all industries—they face problems which can cause confusion and frustration in the day-to-day performance of their jobs. Although all stages of printing production create different sets of problems, problem-solving skills are essential in all areas. Developing a method of solving problems in the best possible way will provide a stepping stone to successful job performance and advancement.

This is the first of three instructional units written to improve these skills. This first unit will focus on the individual. It is hoped that each student take this opportunity to examine a systematic approach to problem-solving and decision-making.

MODULE OBJECTIVE

After completion of activities involving individual and group problem-solving situations, complete a Step/Action Chart outlining the technique used to provide problem-solving skills and obtain a minimum of 85% on a quiz covering the specific objectives of this instructional unit.

SPECIFIC OBJECTIVES

The student will demonstrate the development of their problem-solving skill by:

1. Describing a problem-solving model.
2. Listing the steps in a systematic approach to solving problems.
3. Listing suggestions that will enable each step in solving problems to be accomplished.
4. Recalling three keys to problem-solving.
5. Listing types of decisions in decision-making.
6. Differentiating between problem-solving and decision-making.

Problem Solving and Decision Making Strategies

in the Printing Industry

OUTLINE

- I. Problem-Solving Strategies
  - A. Developed Skill
  - B. Valuable and frequently assessed skill
- II. Problem-Solving Model
  - A. Present State
  - B. Desired State
  - C. Solution Paths
- III. Step-by-Step Approach
  - A. Identify problems
    - 1. Brainstorming
    - 2. Using the "Open Question"
    - 3. Survey or Historical Review
  - B. Specify the Problem to be solved
    - 1. Pareto Analysis, Weighted Ranking, or Nominal Group Process.
    - 2. Express in written or verbal form
    - 3. Focus on language to clarify
  - C. Determine Causes
    - 1. Brainstorming
    - 2. Using the "Open Question"
    - 3. Cause/Effect (Fishbone) diagram
  - D. Specify Major Cause
    - 1. Pareto Analysis, Weighted Ranking, or Nominal Group Process.
    - 2. Express in written or verbal form
    - 3. Focus on language to clarify
  - E. Generate Alternatives to Eliminate Causes
    - 1. Pareto Analysis, Weighted Ranking, or Nominal Group Process.
    - 2. Brainstorming
    - 3. Using the "Open Question"
    - 4. Cause/Effect (Fishbone) diagram
    - 5. List Pro's & Con's
  - F. Select Best Alternatives to Eliminate Causes (Decision-Making)
    - 1. Pareto Analysis,Weighted Ranking, or Nominal Group Process.
    - 2. Using a Decision Screen
    - 3. Using the "Open Question"
    - 4. Cause/Effect (Fishbone) diagram
    - 5. List Pro's & Con's
  - G. Outline Steps to Implement Solution
    - 1. Brainstorming (place ideas on 3x5 cards)
    - 2. Using the "Open Question"
  - H. Determine Possible Pitfalls
    - 1. Look for Problems
    - 2. Be critical of the solution
    - 3. Try to shoot the solution down
- IV. Keys to Problem-Solving
  - A. Think Aloud (Brainstorming)
  - B. Allow Time for Incubation
  - C. Talk about the Problem
- V. Types of Decisions
  - A. Routine
  - B. Impulsive
  - C. Reasoned
- VI. Making Reasoned Decisions
  - A. Short and Long Term Outcomes
  - B. Ease of Accomplishment
  - C. Possible Side Effects
  - D. Risks
  - E. Being Creative or Original

STUDENT ACTIVITY

- Follow along with handout
- Read assignments
- Take notes
- Participate in individual and group activities
- Review individual progress and complete activity checklist
- Complete evaluation
- Review recorded grade

INSTRUCTOR ACTIVITY

- Make transparencies
- Develop related exercises
- Write evaluation
- Review objectives
- Assign reading
- Present lecture information
- Facilitate group activities
- Provide feedback
- Administer evaluation
- Record grade

Problem Solving and Decision Making Strategies

in the Printing Industry

INDIVIDUAL AND GROUP ACTIVITIES

1. Read the following chapter on problem-solving:

Chapter #3 in *Thinking Critically* by John Chaffee, Houghton Mifflin Company, Boston, 1988

OR,

Chapter #7 in *Study and Thinking Skills in College* by Kathleen McWhorter, Scott,-Foresman and Company, Glenview Illinois, 1988

2. Identify the present state, the goal state, and suggest several solution paths for the following situations:

A. You have almost finished typing a document using a wordprocessing program on the Macintosh when the computer peeps and displays a dialogue box.

B. Working in the process darkroom, you turn your back to place a sheet of film on the camera back when someone suddenly turns on the white overhead room lights.

C. You are about to begin the operation of a duplicator when you notice a part of the machine laying on the floor and the power cord pulled out of the wall socket.

3. Working in assigned lab groups, identify, as specifically as possible, the problem involved in the situation appropriate to your assigned lab area and suggest causes:

A. Working in the pasteup area, you are about to wax a line drawing needed for a pastup when you discover that the waxer would not operate with the power switch.

B. Using the Brown Caravel Process Camera, you are about to check the position of the original on the ground glass when you discover the camera lights will not light with the switch.

C. You are setting up the feed on the Multilith 1250, checking the double sheet detector for correct adjustment when you realize that it is not affected by turning the adjustment screw in either direction.

4. Working in assigned lab groups, identify as many solution paths as possible in the situation appropriate to your assigned lab area in activity 3.

5. Working in assigned lab groups, evaluate each of the solution paths you devised in activity 4.

6. Study the problem listed below and apply the problem-solving approach to find a solution. Generate as many solutions as possible, weigh the alternatives, than state the solution you would select. Justify your choice

It is the beginning of the second semester at LTC and you have been offered a job in the printing industry in a company in your home town to start within the week. You are enjoying the year in the program so far and can see the potential in continuing but you are running out of the money you saved last summer to go to school.

ACTIVITY CHECKLIST

ITEM	YES	NO
1. Read assigned chapter in "Thinking Critically"	1	0
or, "Study and Thinking Skills. . ."	1	0
2. Identified present state, goal state,and solutions	3	0
3. Participated in group identification—problem	1	0
4. Participated in group identification—paths	1	0
5. Participated in group evaluation—solutions	1	0
6. Studied the problem given and stated justified solution	1	0

Your Score ______

RESOURCES

1. McWhorter, *Kathleen T., Study and Thinking Skills in College*, Scott, Foresman and Company, Glenview, Illinois, 1988.

2. Chaffee, John, *Thinking Critically*, Houghton Mifflin Co., Boston, 1988.

3. Lee, Howard, Charles Krueger, and Orville Nelson, *VTAE Problem Solving Workshop*, University of Wisconsin-Stout, Menomonie, WI, 1991.

Problem Solving and Decision Making Strategies

in the Printing Industry

EVALUATION-Quiz

1. Using a diagram, explain what is meant by a problem-solving model?

2. List the eight steps used to solve problems:

a.
b.
c.
d.
e.
f.
g.
h.

3. Match the brief phase which describes the techniques used in the problem-solving process:

___ Brainstorming	A. A group assigns a value to each alternative in an effort to select the best one
___ "Open Question"	B. Called a "fishbone" diagram used to analyze causes
___ "Historical Review"	C. Thinking out loud
___ Consensus Decision	D. A list of advantages and disadvantages to a solution
___ Weighted Ranking	E. A method of quizzing group to stimulate thinking
___ Cause/Effect Diagram	F. Discussing what has occurred in past as it pertains to a problem
___ Pareto Diagram	G. Mutual agreement to question by a group
___ Pro's and Con's	H. A graphic representation of data

4. List three keys to effective problem solving:

a.
b.
c.

5. Given one example of each of the three different types of decisions made by individuals:

a.
b.
c.

6. Explain the difference between problem-solving and decision making:

EVALUATION-Chart

PROBLEM SOLVING
STEPS/ACTIONS CHART
Step-by-Step Systematic Approach

Step 1—____________ Problems
1.
2.
3.

Step 2—__________________ to be solved
1.
2.
3.

Step 3—Determine ____________
1.
2.
3.

Step 4—Specify Major _______
1.
2.
3.

Step 5—Generate _______________ to
1.
2.
3.
4.
5.

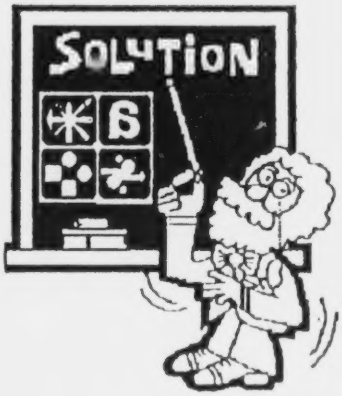
Step 6—______ ______ Alternatives to Eliminate Causes (Decision-Making)
1.
2.
3.
4.
5.

Step 7—Outline _____________ Implement Solution
1.
2.

Step 8—Determine _______ _________
1.
2.
3.

EVALUATION

ITEM		
1. Completion of Individual Activities	Yes	No
2. Participated in Group Activities	Yes	No
3. Completion of Step/Action Chart	Yes	No
4. Quiz-Specific Objectives	Pass	Fail
Instructional Module Completion	**YES**	**NO**



PROBLEM SOLVING
STEPS/ACTIONS CHART
Step-by-Step Systematic Approach

Step 1—Identify problems	1. Brainstorming 2. Using the "Open Question" 3. Survey or Historical Review
Step 2—Specify the Problem to be solved	1. Pareto Analysis, Weighted Ranking, or Nominal Group Process. 2. Express in written or verbal form 3. Focus on language to clarify
Step 3—Determine Causes	1. Brainstorming 2. Using the "Open Question" 3. Cause/Effect (Fishbone)diagram
Step 4—Specify Major Cause	1. Pareto Analysis, Weighted Ranking, or Nominal Group Process. 2. Express in written or verbal form 3. Focus on language to clarify
Step 5—Generate Alternatives to	1. Pareto Analysis, Weighted Ranking, or Eliminate Causes Nominal Group Process. 2. Brainstorming 3. Using the "Open Question" 4. Cause/Effect (Fishbone)diagram 5. List Pro's & Con's
Step 6—Select Best Alternatives to Eliminate Causes (Decision-Making)	1. Pareto Analysis,Weighted Ranking, or Nominal Group Process. 2. Using a Decision Screen 3. Using the "Open Question" 4. Cause/Effect (Fishbone)diagram 5. List Pro's & Con's
Step 7—Outline Steps to Implement Solution	1. Brainstorming (place ideas on 3x5 cards) 2. Using the "Open Question"
Step 8—Determine Possible Pitfalls	1. Look for Problems 2. Be critical of the solution 3. Try to shoot the solution down

June 4, 1991

Problem Solving--
Developing skill through a Leadership Role

in the Printing Industry

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LAKESHORE
TECHNICAL COLLEGE

BEST COPY AVAILABLE

Problem Solving-- Developing skill through a Leadership Role

in the Printing Industry

DESCRIPTION

Success in the printing industry in many instances is dependent on factors controlled by each individual but not easily acquired. Educational level achieved, years of service and experience, skill acquired in a particular production step, or the ability to solve problems in the work environment to name a few. It is generally agreed that effective problem-solving results in effective decision making. “Effective decision makers are made, not born. Some start out with built-in advantages (intelligence level, insight, education, personality factors—all of which differentiate one person from another), but anyone’s track record can improve by following an orderly decision-making (problem solving) process. This process will not guarantee success, but it certainly reduces the chance of failure,” says Joseph T. Straub, author of *Managing, An Introduction.* This material focuses on the individual’s acquired skill to solve problems through two previous units of instruction. The intent of this unit is to place the individual into a leadership position for a two-week period. Observation of duties requiring decision-making will be

MODULE OBJECTIVE

As appointed lead technician in the specialization area chosen during the second phase of the litho lab, the student will perform decision-making duties and be rated on a problem-solving scale for a period of two weeks obtaining a favorable rating of 8.5 or better.

Problem Solving--
Developing skill through a Leadership Role

in the Printing Industry

OUTLINE

I. Review previous information provided on problem-solving and decision making
    A. Problem Solving and Decision Making Strategies
    B. Problem Solving—Cause/Effect and Pareto Diagrams

II. Examine the role and duties of lead technician position as indicated on rating scale

III. Participate a two-week appointment as lead technician
    A. Daily lab operation
    B. Role at weekly production meetings
    C. Special instructor-assigned duties

IV. Review rating and instructor comments

INSTRUCTOR ACTIVITY

- Make transparencies
- Develop evaluative rating scale
- Review objectives
- Schedule lead technicians to two-week periods
- Facilitate production meetings
- Provide feedback to lead technicians
- Administer rating scale
- Record problem-solving ratings

Problem Solving--
Developing skill through
a Leadership Role

in the Printing Industry

STUDENT ACTIVITY

- Read handout
- Take notes
- Review previous instructional units
- Participate in two-week appointment
- Review individual progress and complete activity checklist
- Complete self-rating
- Review instructor rating and comments

INDIVIDUAL ACTIVITIES

1. Read or review information provided concerning problem-solving.

2. Review schedule provided by instructor regarding lead-technician appointment

3. Study Lead Technician Evaluative Report

4. Assume the duties as lead technician as scheduled by instructor.

5. Complete a self evaluation of performance using the Lead Technician Evaluative Report.

6. Consult instructor for comments and observed rating.

LEAD TECHNICIAN EVALUATION REPORT

Satisfactory performance as lead technician will be considered obtained if eleven out of thirteen of the following criteria are observed by the instructor and the overall rating average is 8.5. The scheduled period as lead technician is:

Two week period starting: __________ and ending: ________

Rate each item on a scale of 1(low) to 10(high)

___ 1. Prepares work area for production prior to start of lab period.

___ 2. Assesses quantity of work related items for production.

___ 3. Provides for preventative maintenance on production equipment.

___ 4. Assists in problem solving of others in specialization area.

___ 5. Coaches follow students performing first phase assignments.

___ 6. Provides an example of good work habits leading to quality and efficiently produced jobs.

___ 7. Enforces daily shutdown time providing adequate clean-up.

___ 8. Inspects daily cleanup performed by assigned students.

___ 9. Assists in the performance of Friday cleanup procedures.

___10. Leads in problem-solving techniques during weekly production meeting.

___11. Monitors work-flow and provides effective use of equipment.

___12. Performs lab assigned tasks provided by instructor.

___13. Promotes positive attitudes and student initiative in area.

____Total divided by number of criteria observed____ = _____rating

Problem Solving--
Developing skill through a
Leadership Role

in the Printing Industry

INDIVIDUAL RATING SCALE

Problem Solving--
Developing skill through
a Leadership Role

in the Printing Industry

ACTIVITY CHECKLIST

ITEM	YES	NO
1. Read or reviewed material provided	1	0
2. Reviewed schedule of lead-technician appointments	1	0
3. Studied Lead Technician Evaluation Report	1	0
4. Participated appointment as lead technician	1	0
5. Completed self-evaluation	1	0
6. Consulted instructor	1	0

Your Score _____

RESOURCES

1. Mc Whorter, Kathleen T., *Study and Thinking in College*, Scott, Foresmann and Company, Glenview IL, 1988

2. Schraub, Joseph T., *Managing, An Introduction*, Kent Publishing Co., Boston,.1984

3. Ford, Roberst C., Cherrill P. Heaton, *Principles of Management, a Decision-Making Approach*, Reston Publishing Co., Reston Virginia, 1980.

4. Hebel, Thomas R., *Problem Solving and Decision Making Strategies in the Printing Industry*, Lakeshore Technical College, Cleveland, WI, 1991.

5. Hebel, Thomas R., *Problem Solving—Cause/Effect and Pareto Diagrams for the Printing Industry*, Lakeshore Technical College, Cleveland, WI, 1991.

Problem Solving--
Developing skill through a
Leadership Role

in the Printing Industry

EVALUATION

ITEM		
1. Completion of lab activities as lead technician	Yes	No
2. Participated in production meeting	Yes	No
3. Completed assigned lead-technician tasks	Yes	No
Instructional Module Completion	YES	NO

Problem Solving--
Developing skill through
a Leadership Role

in the Printing Industry

June 3, 1991

Problem Solving--

Cause/Effect and Pareto Diagrams

for the Printing Industry

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LAKESHORE
TECHNICAL COLLEGE

Problem Solving--
Cause/Effect and Pareto
Diagrams

for the Printing Industry

DESCRIPTION

The printing industry has traditionally provided technical support in all phases of production in terms of solving problems related to the production of a printed piece. The term "troubleshooting" is not new to most experienced typesetters, platemakers or press operators. Perhaps what is new are collective techniques used to assist in eliminating problems. The material given here will describe methods used to problem-solve as group or team using these techniques. The intent is to give the student an opportunity to examine tools such as "fishbone" diagrams used to show cause/effect relationships, and Pareto diagrams used to graphically identify main problem areas.

MODULE OBJECTIVE

Given a problem relating to a specialization area and data collected describing the problem, construct a Production Process type of cause/effect chart and a Pareto diagram within the time limit of three production meetings.

SPECIFIC OBJECTIVES

The student will demonstrate the development of their skill to construct Cause/Effect Charts and Pareto Diagrams by:

1. Defining the problem to be analyzed.
2. Brainstorming the processing steps involved.
3. Constructing the problem box and fishbone center line.
4. Listing the processing steps involved.
5. Analyzing the cause and effect relationship of each step.
6. Constructing a Pareto diagram from the data provided.
7. Specifying corrective actions.
8. Presenting analysis to class.

Problem Solving--
Cause/Effect and Pareto
Diagrams

for the Printing Industry

OUTLINE

- I. Cause and Effect Analysis
  - A. History
  - B. Definition
  - C. Description of Use
  - D. Benefits of Implementation
    - 1. Creation process itself is educational
    - 2. Provides for group focus
    - 3. Results in an active search for cause
    - 4. Collection of data
    - 5. Demonstrates the level of problem understanding
    - 6. Useful in solving any problem
    - 7. Promotes problem solution instead of finger pointing
    - 8. Promotes teamwork
- II. Steps in Cause and Effect Analysis
  - A. Define the Problem
    - 1. Histograms of data results
    - 2. Control Chart Results
    - 3. Pareto Diagrams
  - B. Select the Method of Analysis
    - 1. Brainstorming-rules
      - a. all ideas are 'good'
      - b. must give an answer or 'Pass'
      - c. quantity of answers—not quality
      - d. hitchhiking of ideas is encouraged
    - 2. Open Question
  - C. Draw the 'Problem Box' and 'Prime (center) Arrow'
  - D. Specify sources contributing to the problem
    - 1. Machines
    - 2. Methods
    - 3. Materials
    - 4. Personnel
    - 5. Measurement
    - 6. Environment
  - E. Identify Causes
  - F. Diagram the causes
- III. Fishbone Diagram Construction
  - A. Dispersion Analysis Type
    - 1. Individual causes placed within major categories
    - 2. "Why does this cause (dispersion) occur?"
  - B. Production Process Classification Type
    - 1. Follows the steps in production
    - 2. Lists causes found in each step
  - C. Cause Enumeration
    - 1. Cause lists are generated
    - 2. Lists placed in categories
- IV. Pareto Diagrams
  - A. History
  - B. Definition
  - C. Description of Use
  - D. Benefits of Implementation
- V. Steps in making Pareto Diagrams
  - A. Identify problem categories for data collection
  - B. Determine the period of time for collection of data
  - C. Collect data and write summary table
  - D. Construct the diagram
  - E. Plot the cumulative cost
  - F. Analyze the diagram

Problem Solving--
Cause/Effect and Pareto
Diagrams

for the Printing Industry

STUDENT ACTIVITY

- Follow along with handout
- Read assignments
- Take notes
- Participate in individual and group activities
- Review individual progress and complete activity checklist
- Review recorded grade

INSTRUCTOR ACTIVITY

- Make transparencies
- Develop related exercises
- Review objectives
- Assign reading
- Present lecture information
- Facilitate group activities
- Provide feedback
- Administer evaluation
- Record grade

**Problem Solving--
Cause/Effect and Pareto
Diagrams**

for the Printing Industry

INDIVIDUAL AND GROUP ACTIVITIES

1. Read the information provided relating to Cause/Effect Charts and Pareto Diagrams:

Nelson, Orville, *"Cause/Effect Charts and Pareto Diagrams,"* VTAE Problem-Solving Worshop, University of Wisconsin-Stout, 1991.

2. Working in lab specialization groups, brainstorm the problem given below (appropriate to your production area) and complete a Cause/Effect Chart on transparency material:

A. **Copy Preparation**—Frequent errors appearing in text and headline copy on printed materials produced in the production phase of the printing lab especially on personal jobs and in Placement Book.

B. **Negative and Plate Preparation**—Poor quality of reproduction in single color halftone copy in printed jobs and other multi-color promotional materials.

C. **Press and Bindery**—Fifty percent of the final press sheets rejected because of defects on a two-color press run.

3. Working in lab specialization groups, construct a Pareto diagram based on the percent of defects from the data provided for each problem given above (appropriate to your production area) and transfer to transparency material:

Copy Preparation

Defect Code	Defect Category	Total % of Defects
1	Misspelling	40%
2	Transposed Letters	20%
3	Missing Copy	5%
4	Punctuation Errors	10%
5	Wrong Font	3%
6	Line Spacing	10%
7	Type Size	8%
8	Other	4%

Negative and Plate Preparation

Defect Code	Defect Category	Total % of Defects
1	Highlight Too Large	40%
2	Highlight Too Small	20%
3	Shadow Too Large	5%
4	Shadow Too Small	10%
5	Photo Cropped Too Small	3%
6	Halation	10%
7	Contrast Too Low	8%
8	Other	4%

Problem Solving-- Cause/Effect and Pareto Diagrams

for the Printing Industry

Press and Bindery

Defect Code	Defect Category	Total % of Defects
1	Misregister	40%
2	Sheet Wrinkled or Nicked	20%
3	Poor Color Fit	5%
4	Ink Scumming	10%
5	Picking	3%
6	Poor Ink Density	10%
7	Image Hickies	8%
8	Other	4%

4. Working in lab specialization groups, present the cause/effect chart and Pareto diagram to the class from activities #2 and #3 above and describe the corrective action necessary to reduce the percent of defects.

ACTIVITY CHECKLIST

ITEM	YES	NO
1. Read assigned material provided	1	0
2. Defined the problem to be analyzed	1	0
3. Participated in brainstorming of the steps	1	0
4. Participated in the construction of problem box	1	0
5. Participated in listing the processing steps involved	1	0
6. Participated in analyzing each step for cause/effect	1	0
7. Helped to construct a Pareto diagram from data	1	0
8. Participated in the presentation to the class	1	0

Your Score _____

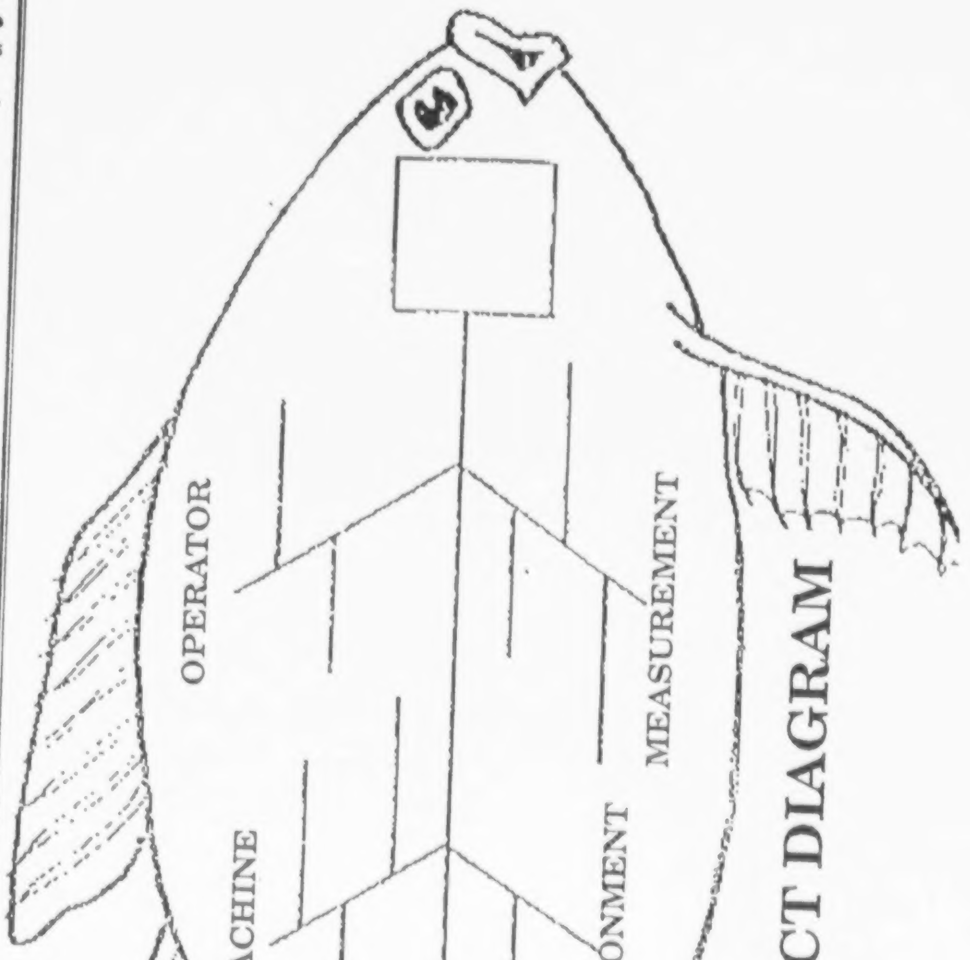
RESOURCES

1. Lee, Howard, Charles Krueger, and Orville Nelson, *VTAE Problem Solving Workshop*, University of Wisconsin-Stout, Menomonie, WI, 1991.

2. Imai, Masaaki, *Kaizen*, Random House, New York, 1986.

3. Ishikawa, K. (1986). *Guide to Quality Control*. White Plains, NY: Quality Resources.

EVALUATION-Chart

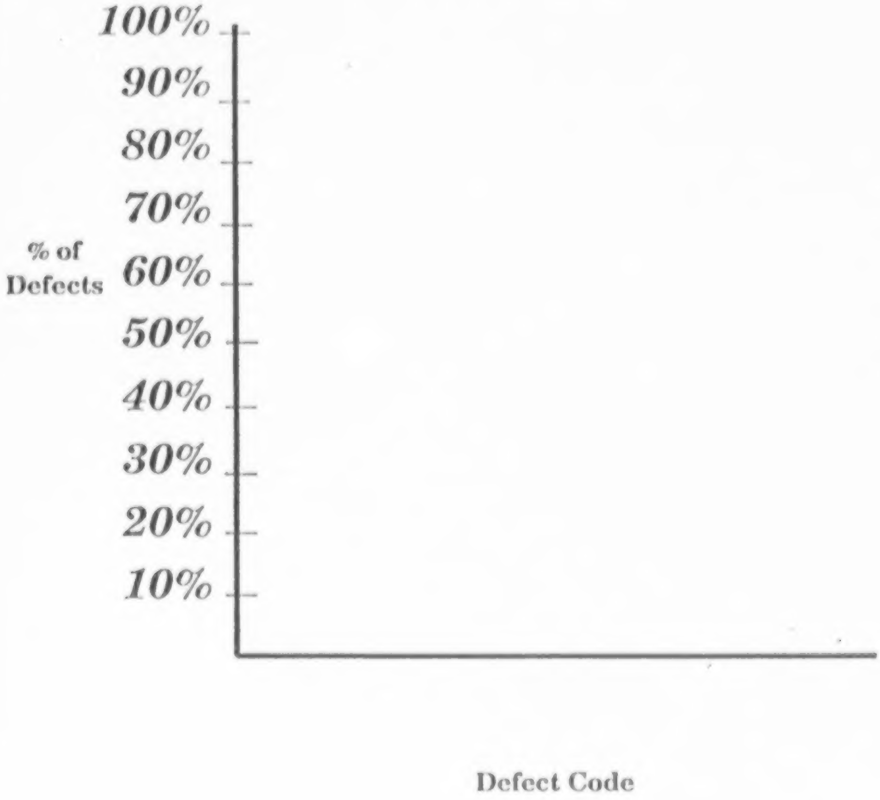

OPERATOR
MACHINE
METHOD
MEASUREMENT
ENVIRONMENT
MATERIALS

CAUSE and EFFECT DIAGRAM

EVALUATION

ITEM		
1. Completion of Individual Activities	Yes	No
2. Participated in construction of fishbone chart	Yes	No
3. Participated in the construction of Pareto diagram	Yes	No
4. Contributed to class presentation	Yes	Yes
Instructional Module Completion	**YES**	**NO**

PARETO DIAGRAM

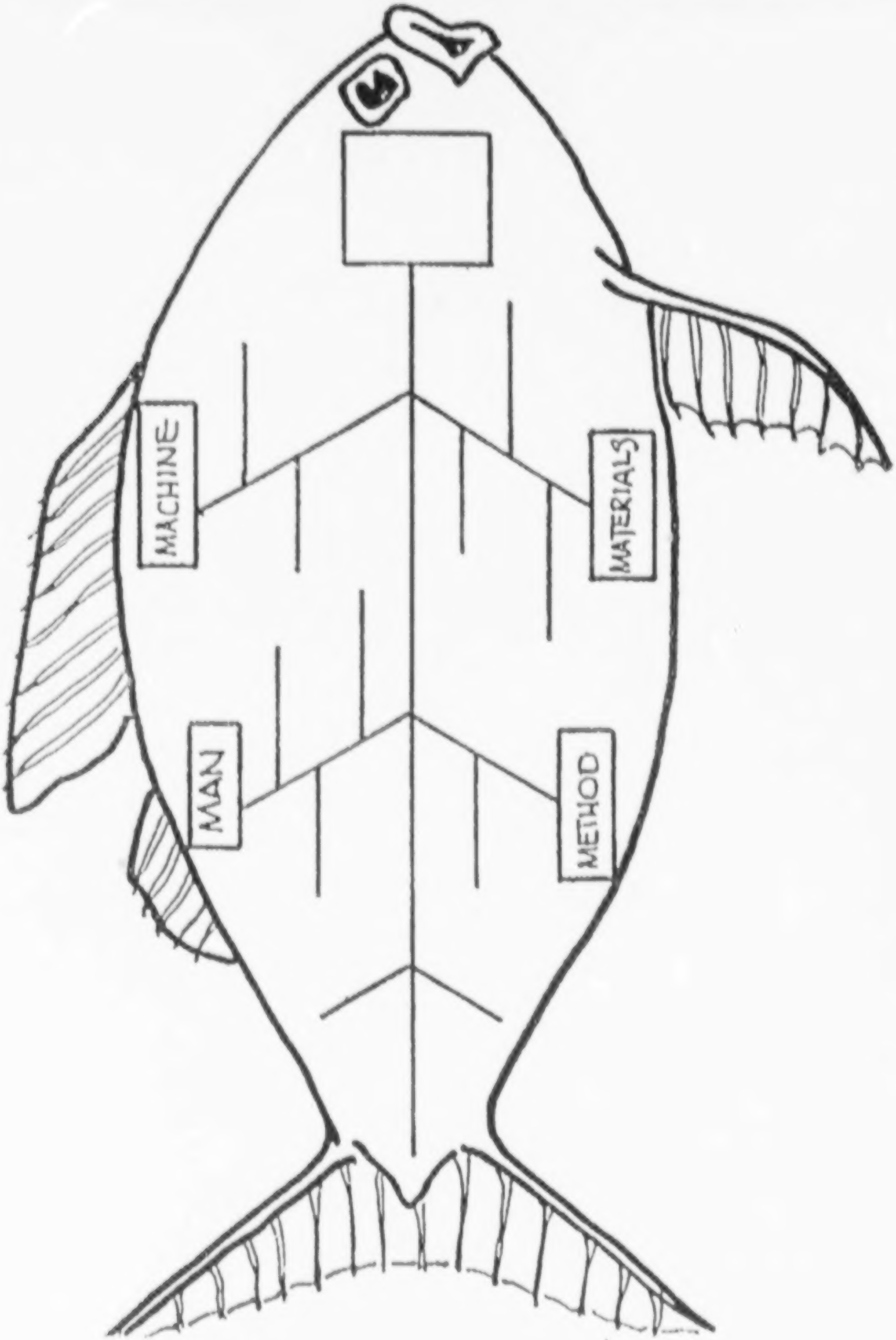


Pareto Diagram based on percent of defects

Appendix C

Sample Instructional Materials

CAUSE AND EFFECT


MACHINE
MATERIALS
MAN
METHOD

Professor Kaoru Ishikawa is credited with developing the first cause and effect diagram in the summer of 1953. The University of Tokyo professor used it to explain the fact that various factors can be sorted out and related in such and such a way. It is used in brainstorming sessions to examine factors that may influence a given situation. It allows for a convenient method of segregating problem causes into a logical order. The diagram is used to show the relationship between a problem and its possible causes and provide an opportunity to graphically develop, explore, and analyze this relationship. We must remember to cure the cause of the problem not cure the symptoms of the problem. The diagram serves to remind those working on quality problems how various causes can operate to produce an eventual effect on the product manufactured. They force people to think explicitly about the specifics of their process as well as their suppliers and customers.

Mary Walton in "The Deming Management Method" summarized the benefits of the use of cause and effect diagrams:

"1. The creation process itself is educational. It gets a discussion going, and people learn from each other.

2. It helps a group focus on the issue at hand, reducing complaints and irrelevant discussion.

3. It results in an active search for the cause.

4. Data often must be collected.

5. It demonstrated the level of understanding. The more complex the diagram, the more sophisticated the workers are about the process.

6. It can be used for any problem."

Cause and effect analysis is useful in any kind of process capability analysis. It tends to make people from different areas of a company or organization aware of production or operational problems and to get them involved in their solution. The focus is on attacking a problem rather than on fixing blame.

It is a tool that helps a team of people work together toward a common end. An individual cannot produce a cause and effect diagram that is as effective as is possible with a group. It focuses on the cause of variability and is used to build a list of potential causes of a quality problem or opportunity for improvement.

It is beneficial to post cause and effect diagrams in the areas where the products are made. Oversize charts are sometimes displayed and employees are encouraged to add causes that may have been overlooked. The cause and effect chart is informative and also encourages participative effort on the part of those concerned with the process.

Cause and effect analysis or diagraming is a formal structure for uncovering problem areas. It focuses on the deviation or dispersion and it is used to analyze how the deviation from the specifications was caused. The steps in a cause and effect analysis are:

1. Define the problem. This step may involve the use of histograms of data results, control chart results, Pareto Diagrams, etc.

2. Select the method of analysis. Often the method of analysis involves brainstorming with a team of representatives from production, engineering, inspection, and any others potentially involved with the item in question.

3. Draw the problem box and prime (center) arrow.

4. Specify the major categories of possible sources contributing to the problem (Machines, Methods, Materials, Personnel, Measurement, and Environment).

5. Identify the possible causes of the problem.

6. Analyze the causes and take corrective action.

Development of causes or generation of ideas (possible causes) is done by using the brainstorming technique. Rules for brainstorming follow:

1. No critique of ideas (all ideas are good).

2. Must give answer or say "Pass."

3. Quantity not quality answers.

4. Hitchhiking encouraged (using another person's ideas to trigger a similar kind of idea).

When actually doing brainstorming, you would continue generating ideas until all ideas are exhausted.

The ideas are grouped into like categories (work force, machines, materials, methods, environment and measurement). Some causes will fit into more than one category. Put such items in all categories where they fit. In administrative areas it may be more helpful to use the four "P's," (Policies, Procedures, People and Plant). These categories are only suggestions. You may use any major category that emerges or helps people think creatively.

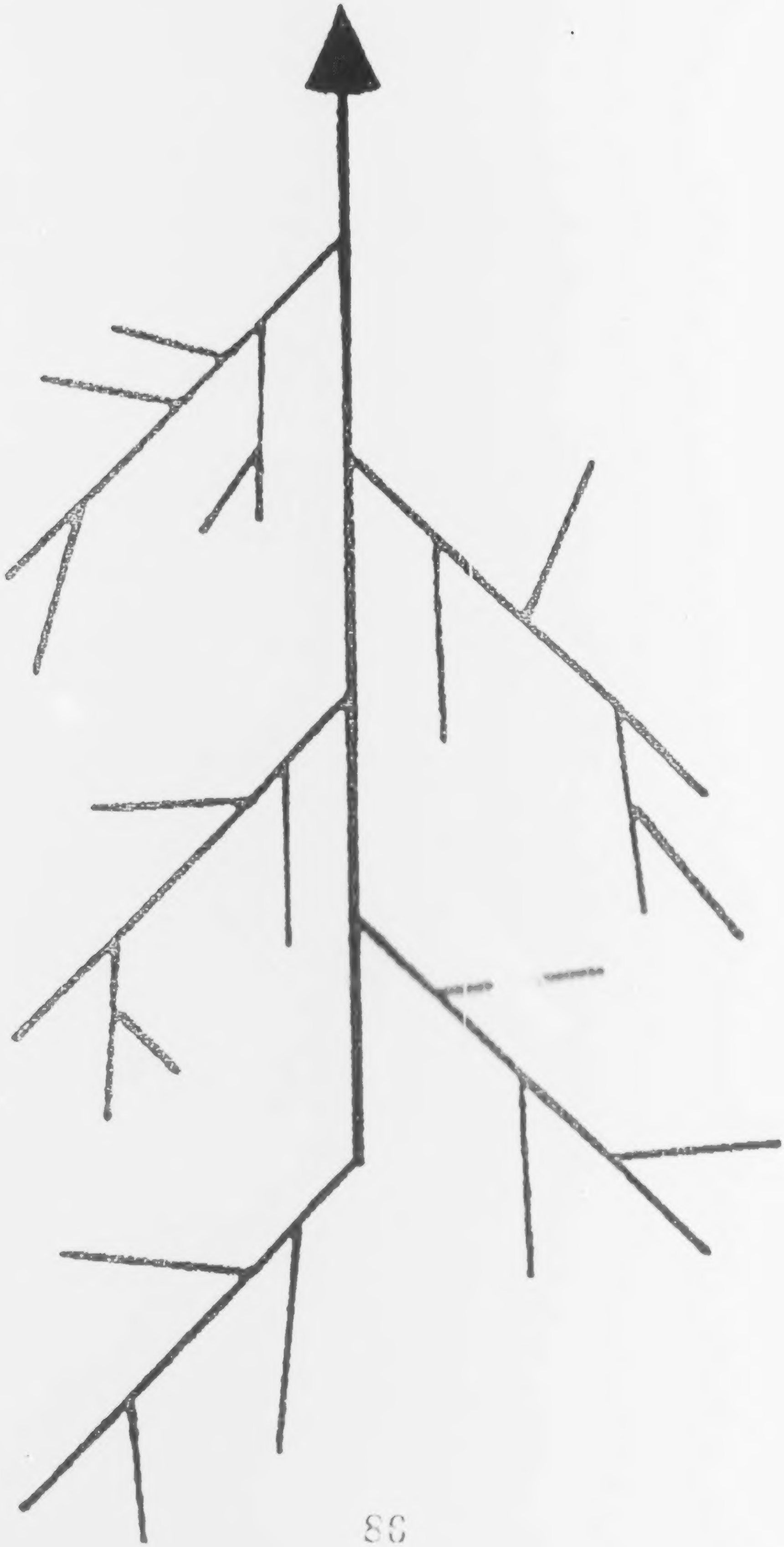
There are various ways to construct cause and effect diagrams:

1. Dispersion Analysis Type: Individual causes are placed within each "major" cause category. The secret of making it is to keep asking "Why does this dispersion (cause) occur?" It involves the breaking of dispersions to their end cause. It also helps organize and relate the factors for dispersion.

2. Production Process Classification Type: This method follows the production process listing all the steps in a process. Dispersion occurs during the production process so we go through the steps in the manufacturing process one by one to seek the causes.

3. Cause Enumeration Type: All possible causes are first organized in list form and they are placed in the major cause categories.

A cause and effect diagram is used when you need to identify and explore and display the possible causes of a specific problem or condition.



GROUP DYNAMICS

EFFECTIVE DECISIONS = QUALITY X ACCEPTANCE

E.D. = Q X A

E.D. = Q/A

E.D. = A/Q

ROLES

TASK LEADER

1.

2.

3.

4.

GUIDANCE LEADER

1.

2.

3.

4.

RELATIONSHIP

1.

2.

TASK
RELATIONAL

COMMUNICATION BALANCE

TASK FUNCTIONS

1. INITIATING: Proposing tasks or goals; defining a group problem; suggesting a procedure or ideas for solving a problem.

2. INFORMATION OR OPINION SEEKING: Requesting facts; seeking relevant information about group concern; asking for suggestions or ideas.

3. INFORMATION OR OPINION GIVING: Stating a belief; providing relevant information about group concern; giving suggestions or ideas.

4. CLARIFYING: Elaborating, interpreting, or reflecting ideas and suggestions; clearing up confusions; indicating alternatives and issues before the group; giving examples.

5. SUMMARIZING: Pulling together related ideas; restating suggestions after group has discussed them; offering a decision or conclusion for the group to accept or reject.

6. CONSENSUS TESTING: Sending up "trial balloons" to see if group is nearing a conclusion; checking with group to see how much agreement has been reached.

GROUP RELATIONS FUNCTIONS

ENCOURAGING: Being friendly, warm, and responsive to others; accepting others and their contributions; regarding others by giving them an opportunity for recognition.

2. EXPRESSING GROUP FEELINGS: Sensing feeling, mood, relationships within the group; sharing one's own feelings with other members.

3. HARMONIZING: Attempting to reconcile disagreements; reducing tension; getting people to explore their differences.

4. MODIFYING: When his own idea or status is involved in a conflict, offering to modify his own position; admitting error; disciplining oneself to maintain group cohesion.

5. GATE-KEEPING: Attempting to keep communication channels open; facilitating the participation of others; suggesting procedures for sharing opportunity to discuss group problems.

6. EVALUATING: Evaluating group functioning and production; expressing standards for group to achieve; measuring results; evaluating degree of group commitment.

Charlie Krueger

MEETING IN PROGRESS

1. How should I start the problem solving?

   A. By pointing out the benefits to follow from a solution of the problem?
   B. With a realistic statement of the consequences of not solving the problem?
   C. With a clear-cut definition of the problem?

2. Silence. How to get things rolling.

   A. Wait. Someone in the group will feel compelled to get the ball rolling again?
   B. Express what you sense is the group's feeling at the moment?
   C. Call on each man for his ideas?

3. Attack on the group - what do you do?

   A. Change the subject diplomatically?
   B. Ask Ansel where that kind of reasoning is going to lead?
   C. Ask the group how they feel about his criticism?

4. How to get back to the problem?

   A. Ask the group how they want to proceed?
   B. Ask the group for more facts about the problem?
   C. Move the discussion away from the sensitive area?

5. How to respond to a direct request to your opinion?

   A. Give the group your opinion and any additional information you have?
   B. Summarize the situation so far without expressing your opinion?
   C. Give Charlie a chance to explain further why he wants to tear down one of the machines?

6. A direct attack made on you?

   A. Defend your statement of the problem?
   B. Communicate your reasoning more clearly so the group will get a fresh start?
   C. Modify your definition of the problem?

7. How to prevent things from going in a circle?

   A. Indicate in a firm but friendly manner that the group is beginning to repeat itself?
   B. Clarify the situation by reviewing the proposed alternatives?
   C. Move the group along by expressing your opinion as to what's causing the problem?

8. Some members feel the groups work is done, what should be done?

   A. Summarize the accomplishments and ask the members to be ready with proposals for correcting the situation at the next meeting?
   B. Keep going by pointing out that the major objective was to arrive at a solution?
   C. Devote some time to trying to reconcile differences before going ahead?

9. A member of the group is not participating, what to do?

   A. Ask him what's bothering him?
   B. Apologize for the group's having criticized him earlier?
   C. Encourage him with individual recognition?

10. Two people in a group are in conflict, what to do?

   A. Have each man reconsider his position before you decide who is right?
   B. Ask the man to get together later and iron out their differences?
   C. Help the men settle their differences by getting the others to give their opinions.

11. Entire group is divided, what should you do?

   A. Let them know where you stand by making your own feelings known?
   B. Ask the group to pick a representative from each point of view to study the matter further?
   C. Try to establish a deeper perception by summarizing the progress so far?

12. How to get participation and commitment you need?

   A. Check out your impression with the group to see if there is actually a consensus?
   B. If most members are willing to carry out the program, assume the rest will accept it, and ask for volunteers?
   C. Let the group know they've done a good job and make the necessary assignments?

© Roundtable Films

Mary: (17 years with the company, has a 2 year old Ford truck). When a new Chevrolet truck becomes available, you think you should get it because you have most seniority and don't like your present truck. Your own car is a Chevrolet, and you prefer a Chevrolet truck such as you drove before you got the Ford.

Bill: (11 years service with the company, has a 5 year old Dodge truck). You feel you deserve a new truck. Your present truck is old, and since the more senior person has a fairly new truck, you should get the next one. You have taken excellent care of your present Dodge and have kept it looking like new. An individual deserves to be rewarded if they treat a company truck like their own.

Walt Marshall - Foreman of Repair Crew

You are the foreman of a crew of repairpersons each of whom drives a small service truck to and from his various jobs. Every so often you get a new truck to exchange for an old one, and you have the problem of deciding to which of your people you should give the new truck. Often there are hard feelings because each person seems to feel they are entitled to the new truck, so you have a tough time being fair. As a matter of fact, it usually turns out that whatever you decide, most of the people consider it wrong. You now have to face the issue again because a new truck has just been allocated to you for distribution. The new truck is a Chevrolet.

In order to handle this problem you have decided to put the decision up to the department themselves. You will tell them about the new truck and will put the problem in terms of what would be the most fair way to distribute the truck. Don't take a position yourself because you want to do what your crew thinks is most fair.

Charlie: (5 years with the company, has a 3 year old Ford truck). The heater in your truck is inadequate. Since Hank backed into the door of your truck it has never been repaired to fit right. The door lets in too much cold air, and you attribute your frequent colds to this. You want a warm truck since you have a good deal of driving to do. As long as it has good tires, brakes, and is comfortable you don't care about its make.

Joan: (10 years with the company, has a 4 year old Ford truck). You have to do more driving than most of the other people because you work in the suburbs. You have a fairly old truck and feel you should have a new one because you do so much driving.

Hank: (3 years service with the company, has a 5 year old Chevrolt truck). You have the poorest truck in the crew. It is 5 years old, and before you got it, it had been in a bad wreck. It has never been good, and you've put up with it for 3 years. It's about time you got a good truck to drive, and you feel the next one should be yours. You have a good accident record. The only accident you had was when you sprung the door of Charlie's truck when he opened it as you backed out of the garage. You hope the new truck is a Ford since you prefer to drive one.

Developing a Competency-Based Problem-Solving Module

VTAE Problem-Solving Workshop Project

Center for Vocational, Technical and Adult Education

April 29-30, & May 1, 1991
University of Wisconsin-Stout
Menomonie, Wisconsin

MODULE GUIDELINES

The following guidelines should be a part of each module developed for the VTAE Problem-Solving Workshop Project:

TITLE: The title portion of the module contains the name of the module. The title is based on the contents of the module being developed. It should be succinct and to the point. Other content experts should readily recognize the title as part of the content.

DESCRIPTION: In this section, the module is decribed and information provided as to where it fits in a sequence of a unit, task or course. A module description explains what the module is about. It is written by the instructor to clarify the module, place the module in the sequence of the course, specify any prerequisites needed, and suggest the kinds of typical activities that students can expect. It should be short and concise. If the module is articulated between courses within a school, or between the secondary and/or postsecondary level, it should be noted here.

NAME, SCHOOL and PHONE NUMBER: The person(s) who developed the module, the name of the technical college and phone number, are listed. This will facilitate contact if other instructors who utilize the module have questions.

(The above three items should be on every cover sheet.)

OBJECTIVES: This section contains a module objective and specific objectives.

1. The module objective states the intended purpose (overall outcome) expected of each student after completion of the module of instruction. A well stated module objective is stated in three parts; the condition, performance and criteria component. See examples in handout.

2. Specific objectives are the subordinate objectives that state what the student must achieve in order to reach the module objective. See examples in handout.

PURPOSE OF OBJECTIVES: Objectives describe in precise terms what the content will be and what responsibilities students will have and provide the roadway for all learners and teachers. It tells you where you are going and when you have arrived. Objectives usually suggest the nature of evaluation.

CONTENT OUTLINE: A first, second and third order outline of content of the module should be provided in this section. Same as a topic outline.

METHODOLOGY: Provide examples of teacher actions to accomplish the objectives of this module. Explain how the teacher will facilitate the activity(ies) to accomplish the objectives.

> Example: Obtain additional materials... Make transparencies... Write worksheet... Provide students with objective sheet.

Additional suggested activities should be listed as needed.

> Examples: Show film on... Show actual components/tools/ instruments, invite speaker to discuss... Arrange and take field trip to... Show pre-recorded VCR presentation of local industry tour, make bulletin board, develop information sheet, etc.

ACTIVITIES: Should include the kinds of things that students will be engaged in to learn the content. Will they be involved in demonstrating something to other students, identifying parts,test a circuit developed, writing a report, programing a routine, recalling information, etc. The objectives will provide a clue as to what students will be doing to demonstrate they have learned the content and met the objectives of the module.

RESOURCES: References needed by students and/or teacher to accomplish the objectives of the module are identified here: may include books, pamphlets, films, brochures, maps, materials, equipment, supplies, etc.

EVALUATION: How will you evaluate the effectiveness of the module and whether students have accomplished the objectives? Will it be based on a module evaluation, a paper and pencil test, a performance test, or a group evaluation? In any case, the evaluation criteria should be identified and listed in this section. Any exams, product or process checklists developed should be included.

Remember: These modules will be shared with various instructors in the field.

Competency-Based Instruction:

In competency-based instruction, student learning us based on specific, precisely stated student outcomes that have been validated. These outcomes are available to students at the begining of instruction and describe exactly what the student will be able to do upon completing the specified training. Students learn with carefully designed, student-centered learning activities, media and materials designed and organized to help the student master the outcomes. The activities are designed so that the student can slow down, stop, speed up, or repeat instruction, as needed to learn effectively. Periodic feedback is an integral part of the learning. Students must fully master the outcome before proceeding with the next outcome. Performance is compared to a preset, fixed standard. The underpinning of competency-based instruction is the behavior objective which states the student outcome.

Benefits of Behavior Objectives:

1. When learners are provided with well-state objectives, they know exactly what performance they are going to master, under what conditions they will be assessed, and how well they must perform to be judged competent.

2. The instructor or curriculum planner can examine the objective (if written properly) and determine what kinds of learning activities might be appropriate for learning the task.

3. The objective determines how the testing situation should be set up and what kinds of evaluation instruments are needed.

4. The objective also reveals the major learning materials and resources (tools, equipment, supplies, etc.) needed for learning the content or task and for testing the learner over mastery of the content or task.

5. Well-stated objectives tend to help keep everyone involved in the teaching-learning process "on task," including trainees, instructors, media specialists, evaluators, and others.

6. Valid objectives can provide an excellent means of looking at program effectiveness.

7. Educational research indicates that simply by informing learners of the objectives to be mastered, learning is enhanced.

8. Using well-stated objectives adds a great deal of precision to the instructional process. By writing down the conditions under which the trainee must perform, exactly what performance is required, and the specific criteria for mastery takes much of the fuzziness out of both the teaching and the learning process.

Components of Objectives:

1. **The Condition Component:** The condition component of the objective describes the setting in which the trainee will be required to perform the task to demonstrate mastery. The condition is often referred to as the given and should be written just as carefully for knowledge or skill objective. The following are examples of the condition component:

   EXAMPLES
   - **Things**
     Given certain tools
     Given consumable supplies or materials
     Using test instruments
     Using manuals, specifications, etc.
     Given a lathe, sterilizer, or other major piece of equipment
     Provided with mock-ups, devices, etc.
     Given objects encountered on the job-soil, broken belt, patron, recipe, etc.

   - **Situations**
     Using live work
     Under some simulated situation
     Presented with pictures, problems, case study
     Given a work order, verbal instructions, blueprint, etc.
     Provided with results of a diagnostic test
     Provided with the data, measurements, parameters, maps, schematics
     Given lists of terms, parts, tools, etc.
     Given a field situation
     Given numbers, figures, or problems

   - **Restrictions**
     Without the use of references, texts, books, manuals
     Without help
     Without calculator, special tools, tables, charts, etc.

   The following tips might be helpful in writing the condition component of objectives:

   1. Avoid a long list of specific tools, equipment, etc., the objective may become quite lengthy and of little use.

   2. Do not include anything, situation, or restriction that is obvious to all concerned, such as "given a work station, welding rods, and torch."

   3. Be careful not to include anything in the condition that the learner should not be given during the testing situation. If the student must determine what tools are needed, or must locate the correct replacement parts before performing a service, do not list these tools and parts in the condition. Mention any special restrictions under which the students will have to perform.

4. Avoid specifying any reference to how the student will learn the task. Do not use phrases such as "given a lecture on," "given the required reading material," etc. The condition focuses on the testing situation - not the learning situation.

5. Avoid making the condition too specific. For example, "given two pieces of polyester 4 inches by 4 inches," might be too restrictive. "Given two pieces of material: would probably be sufficient.

6. The condition stated in the objective should resemble as closely as possible the condition under which the trainee must perform the task on the job. If the worker must be able to type a manuscript on the job when given a handwritten draft, then "given a handwritten draft . . ." should be the condition specified in the objective.

2. **The Performance Component:** The performance component is nothing more than the task statement. However, the task statement may be expanded, additional qualifier added, or altered to describe the performance accepted in the education or training setting. Examples of the performance components are listed below. Note that the task statement has been expanded or made more specific.

EXAMPLES

Tasks	Performance Component of Objective for That Task
1. Lay a diamond pattern	...lay an 8-inch diamond pattern...
2. Clean, gap, and test spark plugs and replace in engine	...remove, clean, and gap the plugs
3. Prepare checks for payment	...prepare the checks and stubs...
4. Measure radial pulse	...measure and record radial pulse rate
5. Take and store cuttings	...take cuttings and bundle...
6. Identify electrical components	...match pictures of components with their names...

The following tips may be helpful when writing the performance component of the objective:

1. Remember that the performance is the heart of the objective it is based on.

2. If clearly worded, someone else should be able to read the performance component of your objective and describe exactly what the student should be able to do to demonstrate mastery of the task.

3. The performance component will describe what performance will be required of the student in the final (terminal) testing situation to be considered competent.

4. Do not confuse instructor performance with student performance. Never use "will teach," "will demonstrate," "will present," or other instructor behaviors. Objectives describe what the student should be able to do.

5. Avoid vague terms such as "demonstrate knowledge of," "understand," "show mastery of," "be familiar with," "know," "learn," or other such phrases that are not clearly observable.

3. **The Criteria Component:** The criteria component describes how well the learner will perform the task for you to conclude that the task has been mastered (job entry level). A student can master almost all key indicators of competence except perhaps one-speed. Criteria generally specify performance in two areas.

EXAMPLES

Process Criteria
(how the student
performs the task)

- Following manufacturer's maintenance procedure
- Within 30 minutes
- Not exceeding flat-rate time by more than 25 percent
- Performing all steps in sequence
- Following safety practices
- Using proper tools and equipment

Product Criteria
(how the finished
product turned out)

- +0.005 inch, +2 mm, + 4 degrees
- According to manufacturer's specs
- Within 10 percent of actual reading
- Within 100 percent accuracy
- Within 90 percent accuracy
- With no errors
- Must agree with instructor's measurements
- To customer's satisfaction
- Salable
- Engine must run smoothly
- No visible cracks or pits
- Conforms to local building code

The following tips may be helpful in writing the criteria component:

1. Keep the criteria at a level high enough to ensure entry-level employment by the student or prerequisite for the next objective. Remember that the competency-based approach should allow each student to continue working on an objective until a high level of mastery is attained; do not settle for minimal competence.

2. Do not make criteria dealing with speed quite as high as would be required for an experienced worker performing the task on the job.

3. Avoid vague criteria such as "to instructor's satisfaction," "to industry standards," "correctly," etc.

4. Avoid tying the criteria to instruction. Do not use phrases such as "following criteria in textbook" or "according to specs in handout." These resources will change - criteria should not.

5. Make the criteria comprehensive enough to include all the important indicators of competence. Include criteria covering typical errors made by students.

6. The minimum acceptable criteria for an objective should be the same for each student in the program.

7. If speed is particularly important on the job, you might want to mention a reasonable time limit in the criteria (or include time as an item on the performance test).

Objective Self-Check

Listed below are several objectives. Some are correct and some are not. Read each objective and check the appropriate column to the right. Indicate what is wrong with the incorrect objective.

	Incorrect	Correct
1. Given a damaged programmable controller paper, pencil, and proper manuals, estimate the cost of repair within 10 percent of actual cost.		
2. Given a bed occupied by a patient and necessary linen, the student will be able to make the bed.		
3. Given a demonstration on inductive reactance, learn the concept to the instructor's satisfaction.		
4. Given a written draft of a new high-technology concept, evaluate the the concept using the eight step problem solving technique. You should write a report consistent with the report guide in your textbook.		

Checklist

Directions: When you have written a module objective, check it using the following checklist.

Criteria for evaluating performance - 100 percent mastery required	YES	NO
For Doing Objectives		
1. Does the condition describe what the student will be provided with during the testing situation?		
2. Is a long list of, or obvious tools, equipment, etc., avoided in the condition?		
3. Is the condition general enough to avoid being too restrictive?		
4. Are things the student should not be given not listed in the condition?		
5. Does the condition closely resemble the setting in which the task is performed on the job?		
6. Are references to learning resources avoided in the condition?		
7. Does the performance tell exactly what the trainee should be able to do at the end of the learning process?		
8. Is instructor performance not mentioned?		
9. Is the performance based on the task statement?		
10. Are phrases such as "the student will," "fully," "correctly," etc., avoided?		
11. Does the criteria component specify how well the task must be performed?		
12. Are criteria at a high enough level to ensure competence, but still be attainable?		
13. Are the major indicators of competence included in the criteria?		

	Criteria for evaluating performance - 100 percent mastery required	YES	NO
14.	Are vague criteria such as "to instructor's satisfaction" avoided?		
15.	Is mention of learning resources avoided in the criteria?		
16.	If criteria are not included in the TPO, is a minimum score on a performance test included?		
	For Knowledge Objectives		
17.	If the objective has a condition, does it describe a problem or testing situation?		
18.	Does performance indicate exactly what the student must do to demonstrate mastery of the task?		
19.	Do criteria (if included) specify a minimum acceptable level of performance?		
20.	If criteria are not included, is a minimum score on a written test included?		

GRAPHS
A Sample Module

VTAE Problem-Solving Workshop Project

Center for Vocational, Technical and Adult Education

April 29-30, & May 1, 1991
University of Wisconsin-Stout
Menomonie, Wisconsin

TITLE:

Graphs - A Sample Module

DESCRIPTION:

Graphs are often used as a tool for organization, summarization, and statistical display to aid in the analysis of data. It is a frequently used technique for quality control. This module describes the types pf graphs and their use. This module may be introduced in any course when data being used can be presented effectively with graphs. No prerequisites are required. Students will apply what they learn in this module to various situations where appropriate.

NAME, SCHOOL and PHONE NUMBER:

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OBJECTIVES:

Module Objective: (Competency - Select and display data using graph)

Given data, display data using an appropriate graph scoring 6 of 10 on the product checklist.

Specific Objectives: At the completion of the module, the student will be able to:

1. Differentiate between a line graph, bar graph and circle graph

2. Recall advantages and disadvantages of line, bar and circle graphs

3. Plot a line, bar and circle graph

4. Given data, select appropriate graph, justify selection, graph data and present to class

CONTENT OUTLINE:

1. Purpose of graphs

   A. Using the right side of the brain
      1) Retention research and recall
      2) Using whole brain

   B. Uses
      1) Organization
      2) Summarization
      3) Statistical display
      4) Aid in analysis

2. Types of graphs

   A. Line graphs
      1) Advantages
      2) Disadvantages
      3) Uses
      4) Examples

   5) Data and problems

B. Bar graphs
   1) Advantages
   2) Disadvantages
   3) Uses
   4) Examples
   5) Data and problems

C. Circle graph
   1) Advantages
   2) Disadvantages
   3) Uses
   4) Examples
   5) Data and problems

3) Developing graphs

A. Hand drawings
   1) Sketching techniques
   2) Graph paper

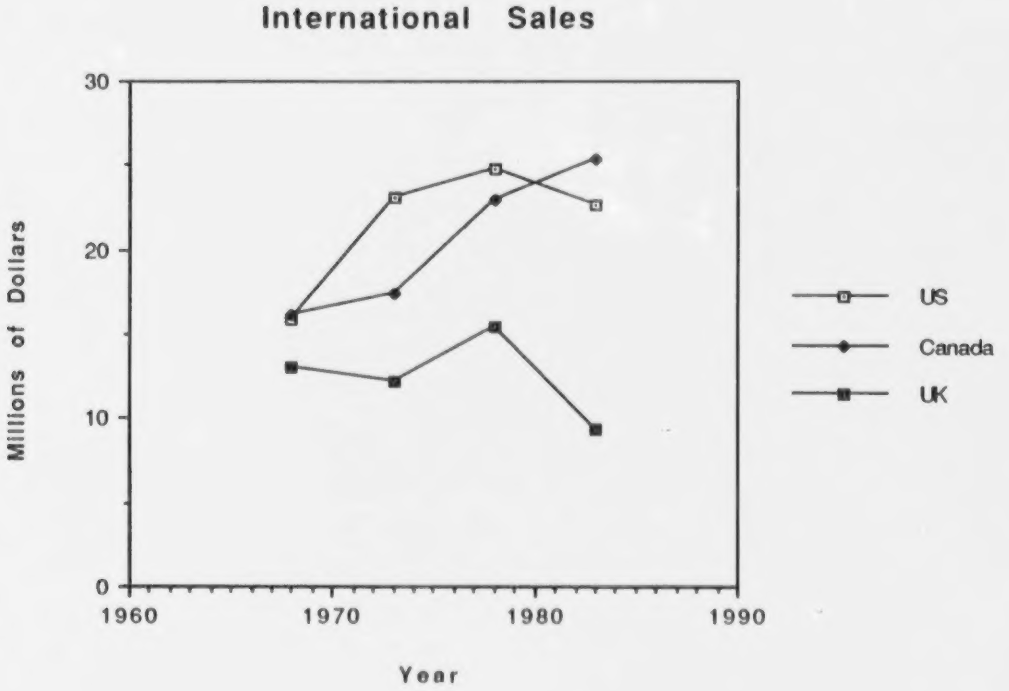
B. Computer generated
   1) Typical advantages
   2) Programs

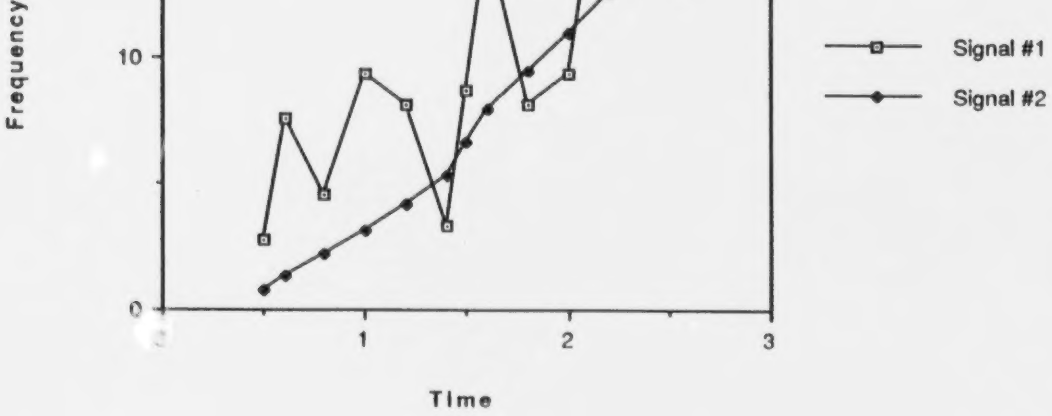
METHODOLOGY:

Teacher Activity	Student Activity
• Make transparencies	
• Develop examples and activity sheets	
• Develop evaluation	
• Review objectives	• Follow along with handout
• Assign reading	• Read assignment
• Present information (lecture)	• Take notes
• Provide examples of graphs	• Review examples
• Assign group work	• Complete group work
• Provide feedback and grade work	• Review feedback and grade
• Administer evaluation	• Complete evaluation
• Grade evaluation	• Review graded work

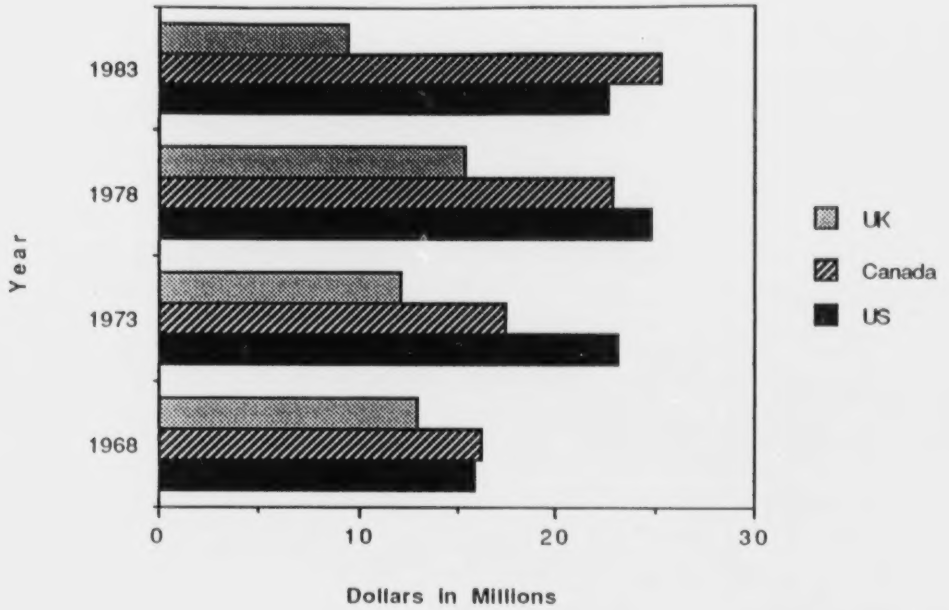
ACTIVITIES:

1. Review samples of graphs (attached)

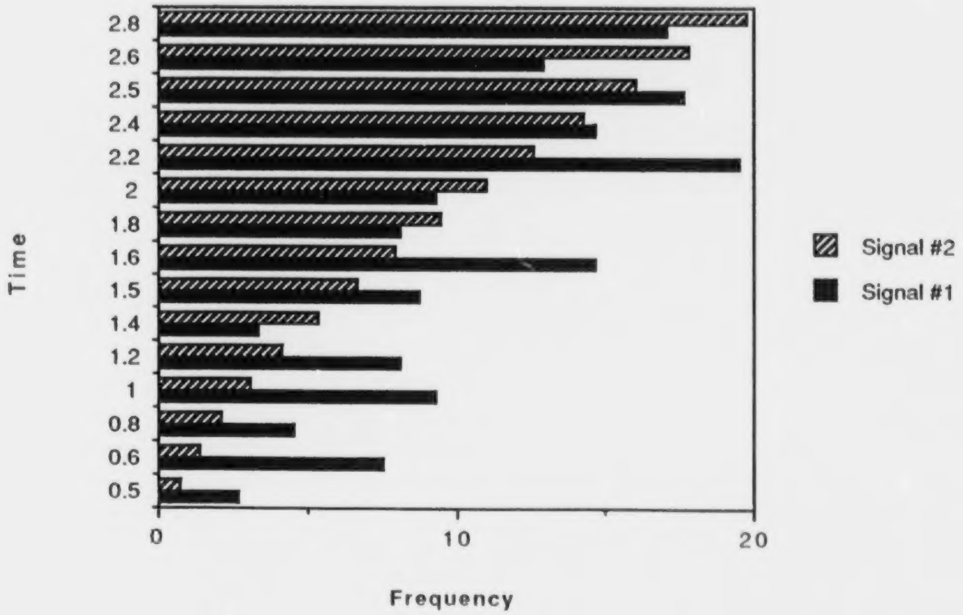

International Sales
Millions of Dollars
30
20
10
0
1960
1970
1980
1990
Year
US
Canada
UK

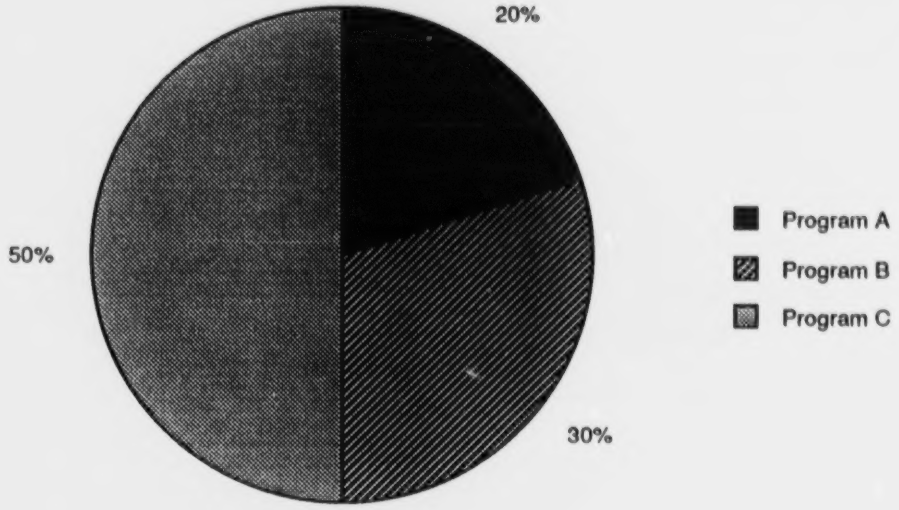

Time and Frequency
Frequency
20
10
0
0
1
2
3
Time
Signal #1
Signal #2

International Sales

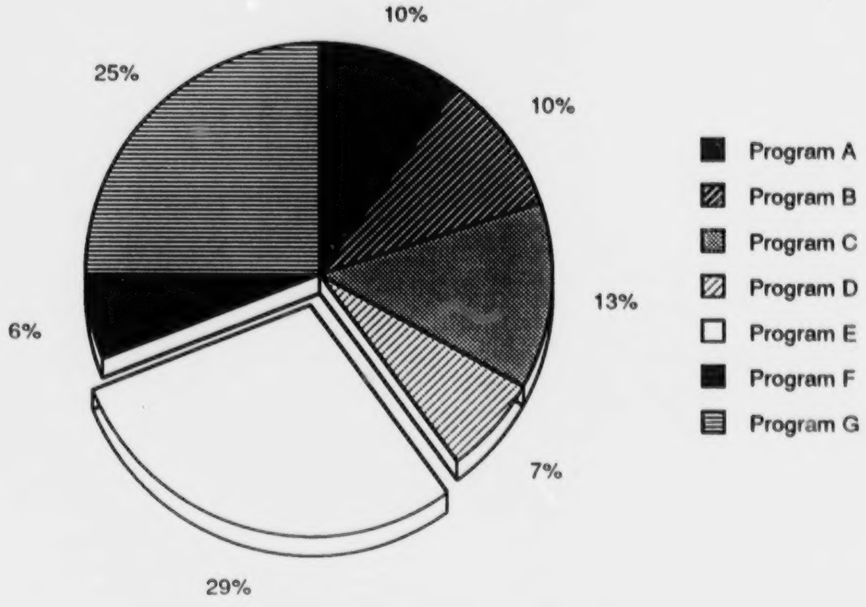


Time and Frequency





Enrollment By Program

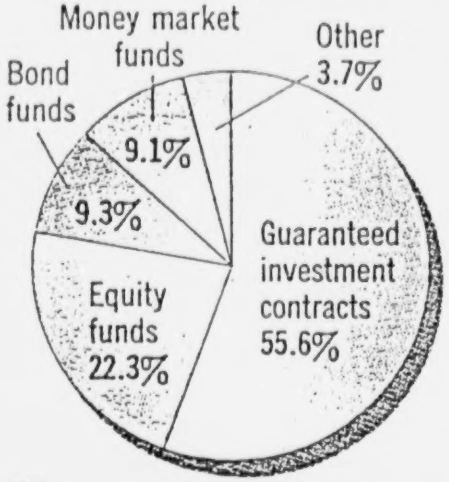


Enrollment By Program

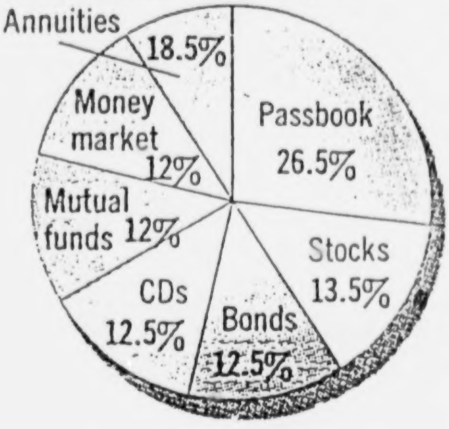
oomers Retire

The risk of conservative savings

1 Employees play it safe when investing their 401(k) funds...

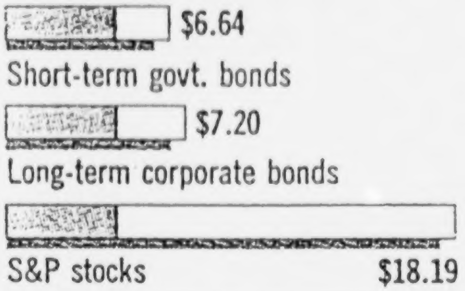


2 ... as they do with other retirement investments..

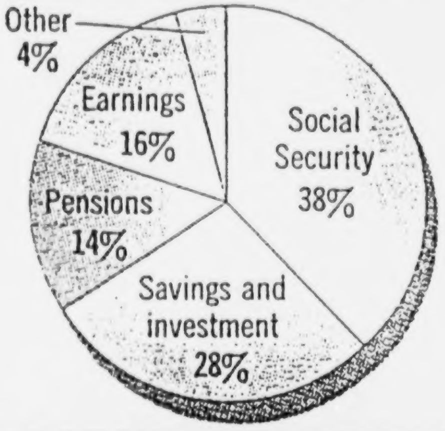


3 ...but too conservative an investment can backfire if it fails to keep up with inflation.

Value in 1991 of $1 invested in 1961 in each area (lighter section of bar shows $4.49 lost to inflation over the period)



Current sources of retirees' incomes



Source: Greenwich Associates, Greenwich, Conn., Merrill Lynch PierceFenner & Smith, Fidelity Investments, Treasury Department , Miami Herald

KNIGHT-RIDDER TRIBUNE NEWS

2. Complete activity sheet (sample below)

Graph Activity Sheet

Objective: Using given data, develop a line and bar graph scoring 13 of 17 points of the criteria listed below.

Requirements: Identified below is data found in the typical newpaper (April 23, 1991). Using what you have learned so far, use the information under the Twin Cities Hourly Temperature and Humidity to plot a separate line and bar graph of temperature and humidity. Also develop a single graph using both the temperature and humidity. Each graph should be named, a key developed, be proportional and fit within a 8 1/2 X 11 sheet, labeled completely, have clear crisp lines and be easy to read and understand. You will be evaluated on the following criteria.

1. **Each of the Graphs Has a Name:**

No Name			All Named
0	1	2	3

2. **A Key is Developed and Labeled:**

No Key or Label			Key Provided and Full Labeled
0	1	2	3

3. **X and Y Axis Clearly Labeled:**

No Label				Each Axis Labeled
0	1	2	3	4

4. **Each Graph is on 8 1/2 X 11 Sheet:**

Graph Does Not Fit Sheet			Uses Whole Sheet
0	1	2	3

5. **Graph is Proportional:**

Did Not Use Proportional Rules		Used Proportional Rules
0	1	2

6. **Lines are Clear and Crisp:**

Poor Line Weight	Good Lines
0	2

Your Score _____

FOR THE RECORD

MONDAY		Normal	1990	Record/Year
Low temperatures	37	39	51	25 in 1967
High temperatures	57	60	81	90 in 1980

Daily high and low are not reflected in the list below if they occur between hourly readings.

TWIN CITIES HOURLY TEMPERATURE AND HUMIDITY

Hour	T	H	Hour	T	H	Hour	T	H
Midnight	46	43	8 a.m.	48	63	4 p.m.	49	86
1 a.m.	43	53	9 a.m.	51	56	5 p.m.	51	56
2 a.m.	42	62	10 a.m.	52	61	6 p.m.	51	46
3 a.m.	41	60	11 a.m.	54	64	7 p.m.	49	48
4 a.m.	39	67	Noon	56	57	8 p.m.	47	51
5 a.m.	41	70	1 p.m.	55	64	9 p.m.	47	47
6 a.m.	42	70	2 p.m.	52	74	10 p.m.	45	55
7 a.m.	44	70	3 p.m.	45	93			

PRECIPITATION	Monday	Month to date	Year to date
Total	.08	1.83	5.64
Normal		1.36	4.74
Departure		+.47	+.90

POLLEN AND MOLD

(24 hours ending 7:30 a.m. Monday)

Pollen count was Average with 146 grains per cubic meter of air.

Mold count was Low with 106 spores per cubic meter of air.

FOUR-STATE TEMPERATURES AND PRECIPITATION

Minnesota	H	L	Pcp.
Alexandria	48	42	.02
Duluth	44	26	.23
Grand Marais	41	25	
Hibbing	41	27	.09
Internat'l Falls	40	31	.15
Redwood Falls	55	44	.02
Rochester	58	37	.18
St. Cloud	52	32	.08
North Dakota			
Bismarck	56	36	T
Grand Forks	39	36	.21

Wisconsin	H	L	Pcp.
Eau Claire	61	30	.24
Green Bay	62	29	
La Crosse	63	35	NA
Madison	62	29	
Milwaukee	58	37	
Wausau	61	30	
South Dakota			
Aberdeen	57	41	
Huron	60	39	T
Sioux Falls	61	41	T

Reports are as of 7 p.m

HEATING DEGREE

3. Work in cooperative learning groups (sample below)

   Graph Group Assignment:

   Objective: Given data, select appropriate graph, justify selection, graph data and present to class.

   Requirements: You will frequently have to work with others in a company to present or defend a proposal. In this assignment, review the attached data as a group, consider all the possible ways of presenting it and select an appropriate graph. Be prepared to defend your groups selection of the graph type. Perform the required research and graph the data. Prepare handouts and appropriate visuals for your presentation. Use the graph to present your data.

   Your graph will be evaluated using the **Graphic Assignment Checklist.**

CONSUMER INTEREST RATE SAMPLER

SAVINGS

SAVINGS YIELDS

Following are the annual effective yields offered on April 20 in the Twin Cities by the largest financial institutions. Yields for certificates of deposit are based on the minimum deposit to open an account and the institution's compounding method. Minimums for CDs vary and many institutions offer higher yields on larger deposits. Quotes for money market savings accounts are based on a $2,500 deposit.

The yields shown are guaranteed only on the date of the survey and may change at any time. You should call the institution to verify the yield before opening an account. You also should ask what monthly fees and charges are, and what penalties are applied if you withdraw your money before a certificate of deposit matures.

Most savings rate information supplied by Barlow Research Inc., Minnetonka.

	Money mkt. accounts	6-month CD	1-year CD	2½-year CD	5-year CD
Banks					
First Banks	5.27	5.60	6.00	* 6.60	6.90
Norwest Banks	5.35	5.60	6.00	6.60	7.00
Marquette Bank, Minneapolis	4.59	5.60	6.00	6.60	6.90
American Bank, St. Paul	5.27	5.80	6.22	6.90	7.18
National City, Minneapolis	5.64	5.95	6.35	* 6.82	7.40
Midway National	5.65	5.80	6.15	* 6.65	7.25
Richfield Bank and Trust	5.75	5.99	6.19	6.86	NA
Commercial State, St. Paul	5.38	5.95	6.19	* 6.19	NA
Eastern Heights State	5.64	5.80	6.00	* 6.70	7.40
Princeton State	5.12	5.82	6.71	6.92	5.88
Bank of St. Paul	5.38	6.00	6.25	* 6.75	7.00
Thrifts					
TCF	5.50	6.00	6.30	7.10	7.50
Investors Savings	5.75	5.85	6.30	7.00	7.25
Metropolitan Federal***	5.50	6.05	6.30	7.00	7.40
Credit Unions					
State Capitol	5.90	5.90	6.00	NA	NA
Twin City Co-ops	5.54	6.08	6.40	6.98	** 7.24

* For 2-year certificate
** For 4-year certificate
*** Rates may vary at locations outside the Twin Cities area.

Graphic Assignment Checklist

Item	Yes	No
1. Graph selected is appropriate	1	0
2. Graph has a complete title	1	0
3. Key is provided	1	0
4. All lines are labeled	1	0
5. Lettering is easy to read	1	0
6. Appropriate scale is used	1	0
7. Lines are crisp and clear	1	0
8. Graph has good proportion	1	0
9. Graph made data clear	1	0
10. Footnotes provided	1	0

Your Score ____________

4. Give oral presentation (sample evaluation below)

PEER EVALUATION

Your assignment as a group, is to rate the group that has made the presentaion using the criteria identified below:

PRESENTATION CHECKLIST

Criteria	Yes	No
1. The group sufficiently described the process they used for the graph.	1	0
2. There was evidence of planning for this presentation.	1	0
3. Handouts were appropriate and useful.	1	0
4. There was good use of visual aids.	1	0
5. Everyone in the group participated.	1	0
6. Questions were answered adequately.	1	0
7. We learned something from this presentation.	1	0

Total Points Earned ________

RESOURCES:

1. Glass, G.V., & Stanley, J. C. *Statistical Methods in Education and Psychology*, Prentice-Hall, Englewood cliffs, New Jersey, 1970.
2. Ishikawa, K. *Guide to Quality Control*, Quality Resources, White Plains, NY, 1986.
3. Minium, E.W., *Statistical Reasoning in Psychology and Education*, 3rd Edition, John Wiley & Sons, New York, 1988.
4. Morris, L. L., & Fitz-Gibbon, C. T., *How to Present an Evaluation Report*, Sage Publications, Beverly Hills, 1989.
5. The following Apple software programs:

   - Aldus Persuasion, Seattle, WA 1990
   - Pagemaker, Seattle, WA 1990
   - Cricket Software, Malvern, PA 1987

EVALUATION:

(see assignments)

PARETO DIAGRAMS

Prepared by

Orville Nelson

VTAE Problem-Solving Workshop

Center for Vocational, Technical and Adult Education

April 29-30, and May 1, 1991
University of Wisconsin-Stout
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PARETO DIAGRAMS

Pareto

Pareto Diagrams were named after Vilfredo Federico Damaso Pareto who was born in Paris in 1848 and lived until 1923. Pareto was a civil engineer, a sociologist, and most importantly, an outspoken political economist. During the late 1800's, he made extensive studies about the unequal distribution of wealth. His research indicated that a small amount of the population had a significant portion of wealth. This "Pareto Principle," that wealth is "maldistributed," became popular and carried over into the field of Quality Assurance.

Quality costs are always "maldistributed." Without exception, relatively few of the cost contributors account for the bulk of the costs. Dr. J.M. Juran, applied the Pareto concept to quality control for the purpose of pinpointing specifics and solving the most significant problems. Although Juran refined the techniques introduced by Pareto making them practical for use, Pareto is still given credit for the fundamental principles.

Pareto Process

Frequently a Pareto analysis is based on the dollar cost of each major category of defects. After identifying all of the possible contributors of quality-related losses, it is necessary to categorize them and determine the dollar value of each loss category.

> Example: Suppose that a manufacturer identifies five main categories or causes for quality losses and four minor causes for quality losses for products shipped from the plant. The five main causes for quality losses are: (1) wrong item shipped; (2) incorrect count/wrong amount; (3) shipped to wrong address; (4) late shipment; and (5) quality does meet requirements. Dollar values are assigned to each cause. The cost contributors with the largest dollar-loss values are listed first in a Pareto Chart.

Pareto Diagram

Research suggests that we perceive about 83 percent of our information visually. A Pareto Diagram is a graphic way of summarizing data, such as the quality losses in the table below, in order to identify the main problem areas. The diagram developed will assist in deciding which quality-cost problems should be given attention first. The diagram is constructed like a bar graph, with the largest dollar-loss contributor displayed at the left as the first column. The bars on the bar graph touch each other. The area covered by the bars represents the total cost of the quality problems. See Figure 1.

Table 1: Defect and Cost Summary

Defect Code	Defect Category	Total Number Defectives	Cost/Defective	Total Cost
1	Wrong Item Shipped	40	$585	$23,400
2	Late Shipment	15	$450	$ 6,750
3	Poor Quality	10	$500	$ 5,000
4	Incorrect Count/Amount	35	$110	$ 3,850
5	Shipped Wrong Address	11	$225	$ 2,475
6	Other	9	$200	$ 1,800
	Total	120		$43,275

Many times a cumulative line is added as a part of the Pareto Diagram. The cumulative line represents the sum of the vertical bars as they are added together from left to right. In order to construct a cumulative line, a vertical scale based upon 100 percent is drawn to the right of the columns. The scale should be in multiples of 10 percent.

To construct the cumulative line, draw a straight line from the lower left-hand corner to the upper right-hand corner of the first column or bar. The other columns are added until the cumulative line reaches 100 percent. See Figure 2.

Most organizations have limited resources to solve problems; thus, if resources are to be expended effectively, the Pareto analysis and diagram will help to assure that they are directed to the causes that will yield the greatest cost savings or increase in productivity.

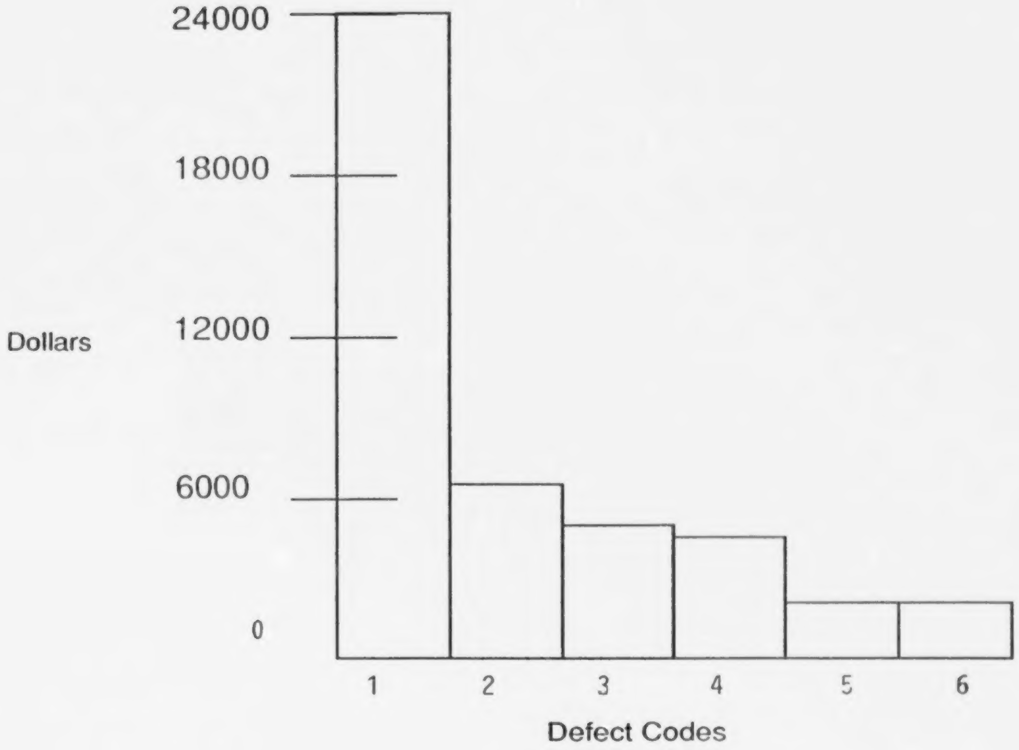

Figure 1: Pareto Diagram

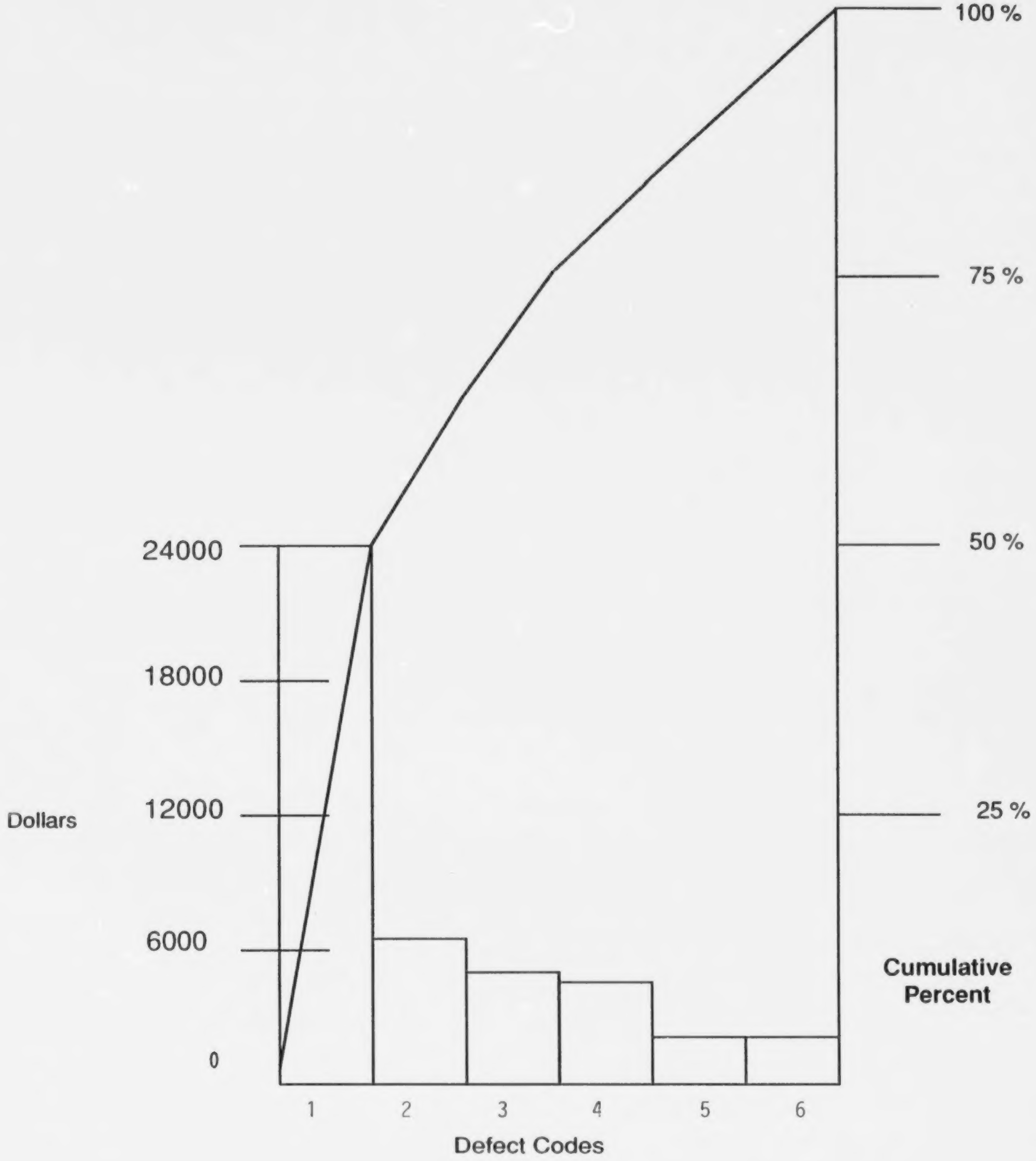

Figure 2: Pareto Diagram with Cumulative Cost Line

Frequently Pareto Diagrams are drawn using the frequency of occurrence of various categories of defects. This is a good alternative when it is difficult to determine the total cost of each type of defect or the costs per type of defect are very similar. The frequency data from Table 1 were used in constructing the Pareto Diagram in Figure 3. Note that the priorities for problem solving change.

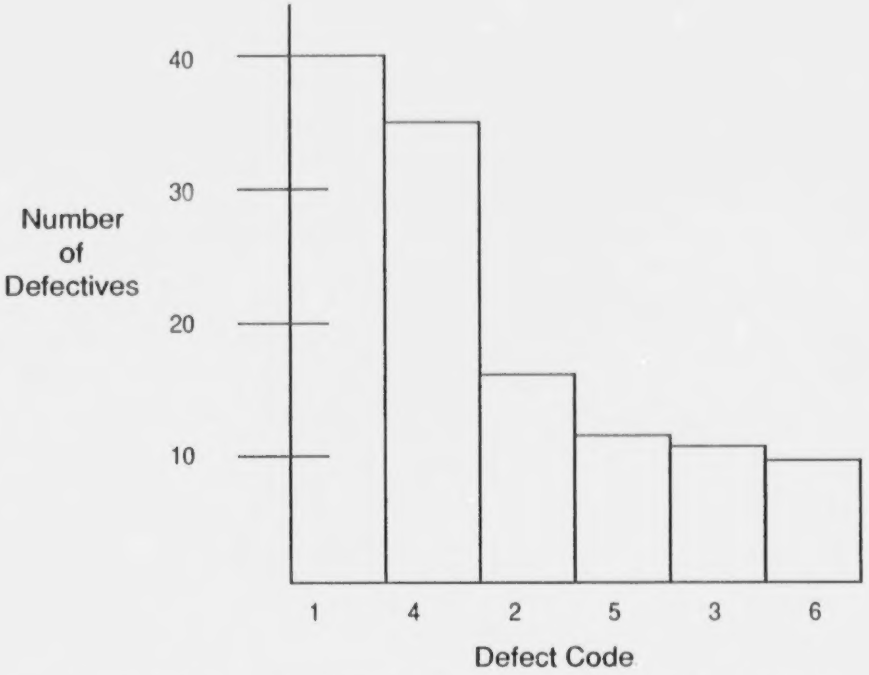

Figure 3: Pareto Diagram Based on Number of Defectives

Procedures

The following steps are involved in making a Pareto Diagram:

1. Identify the defect or problem categories to be used in collecting your data. Try to use categories that are useful in other activities and departments. One of the goals of this process is to synthesize and simplify. Thus, the classifications should be created to include similar problems, problems that occur in the same department, etc. In the example, all defects that involve shipping of the wrong item were placed in one category even though there may have been forty incorrect addresses.

2. Determine the period of time in which the data will be collected. Use a convenient period such as one production run, one week, one quarter, or one year. Use the period employed for other records. Keep the time period the same for successive charts for the same area.

3. Collect the data and develop a summary table. See Table 1.

4. Construct the Pareto Diagram.
   - Use the vertical axis for the number, cost and/or percent of defective items
   - Place the defect or problem codes on the horizontal axis
   - Place the tallest bar, the one representing the most defective items or greatest cost on the left, then the next tallest, etc. The bars are of equal width and should touch each other. The total number of defective items is representative by the area of the bars

5. Plot the cumulative cost line. See Figure 2. Note, this could also be done on Figure 3 and would result in a cumulative number line. The cumulative line starts in the first bar. The line starts in the lower left corner of the first bar and runs to the upper left corner.

6. Title and label the diagram and date it.

7. Analyze the diagram.
   - The taller bars represent the most critical problems
   - Experience has demonstrated that more impact can be made by studying/working on these problems
   - It may be necessary to use a cause-effect chart to determine the causes of the problems shown in the Pareto Diagram

Reference

Ishikawa, K. (1976). Guide To Quality Control. Tokyo: Asian Productivity Organization

PARETO DIAGRAM ACTIVITY

Directions: Proof this document and develop a Pareto Diagram. Identify the problems you would try to solve first.

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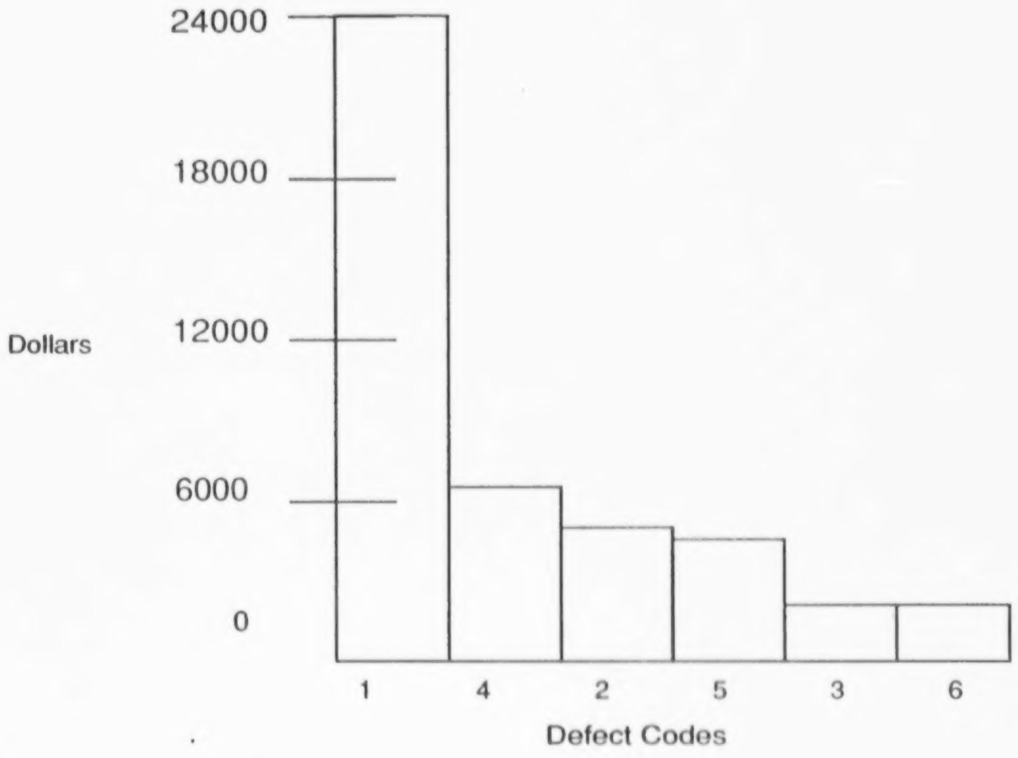
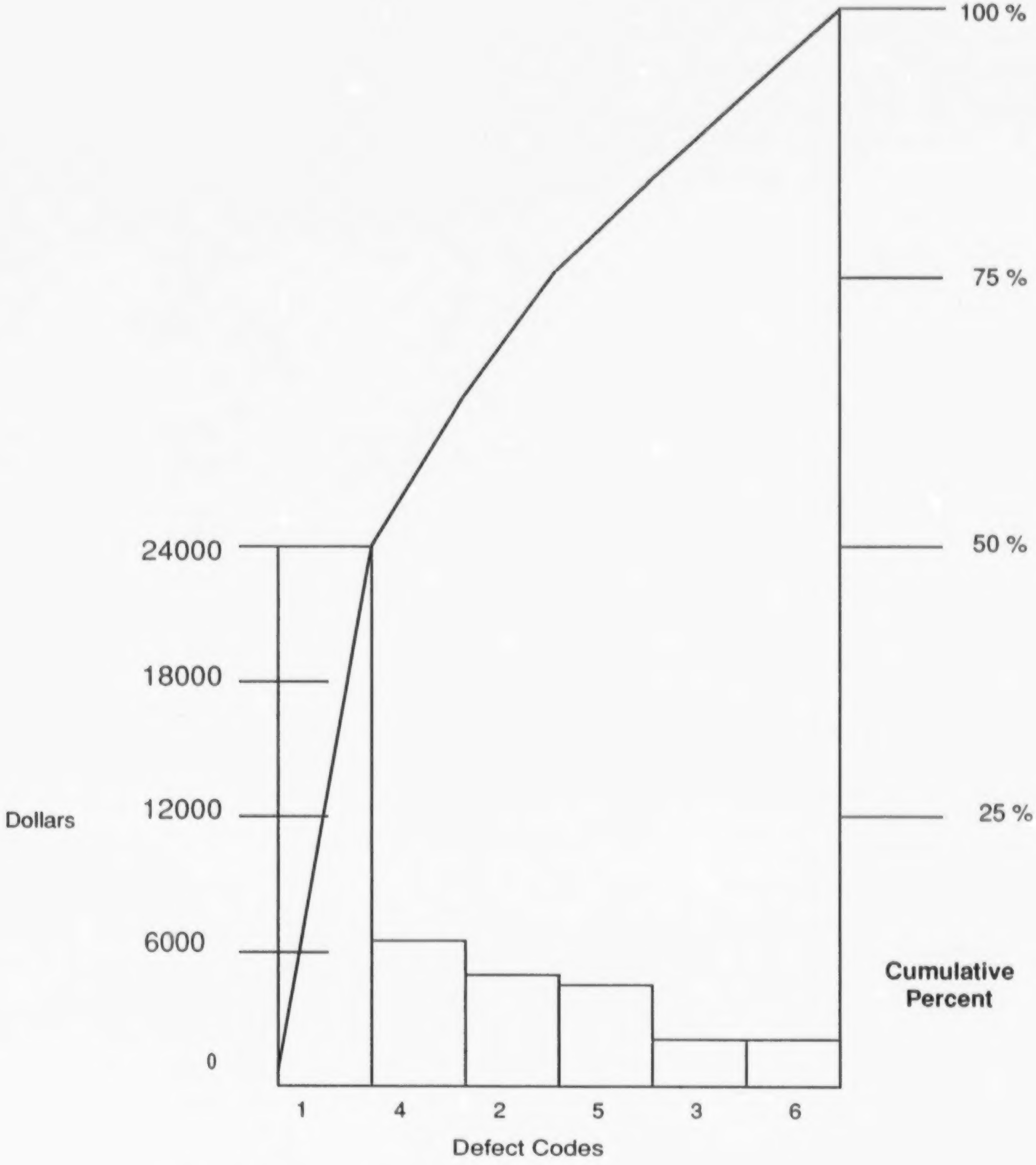


Figure 1: Pareto diagram



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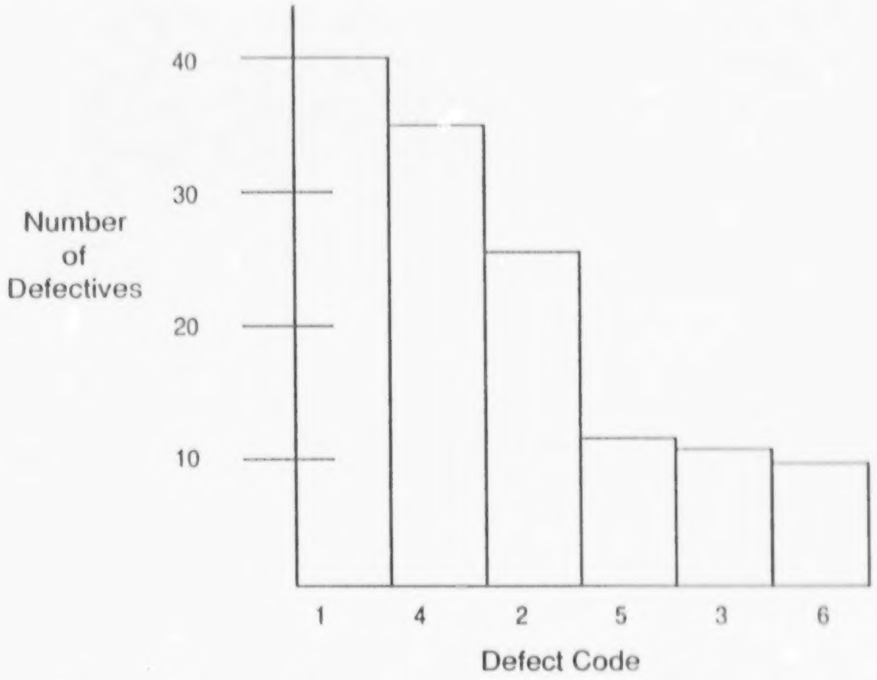

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SYSTEMS ANALYSIS

Prepared by

Orville Nelson

VTAE Problem-Solving Workshop

Center for Vocational, Technical and Adult Education

April 29-30, and May 1, 1991
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Systems Analysis

The systems analysis technique is a structured approach for analyzing a problem or situation to identify the variables or components involved. A system is comprised of two or more elements that interact to produce an output. These elements may be people, people and machines, people and information, people and organizations, or other combinations of these elements.

The starting point in a systems analysis is to identify the purpose of the system. The purpose might be identified in terms of the specifications for parts to be produced, the volume of output, or reduction in the number of defective parts. After the purpose for a system has been identified, the next step is to list the outputs. These outputs should be stated in the same form or terms as the purpose. For instance, if the purpose states that parts will have a tolerance of plus or minus .001, then the output should be measured and identified in the same dimensions.

The next step is to identify the inputs to the system. Inputs are elements that are going to be changed as a result of being processed in the system. In a manufacturing system, inputs would usually be raw materials. Processes are the next component of a system. A process is an action that changes an input into an output. There may be one or several processes used to change the inputs into the outputs desired. Various characteristics of the processes and their sequence are important.

Any system operates in some type of an environment or context. Potential elements in the environment are the physical environment in which the processes take place, the human resources available to operate the system, and the informational resources available. Competition is also typically a factor in the environment for most companies.

A sample systems analysis is given in Figure 1. The value of a systems analysis lies in the structured approach it provides for analyzing a problem and the fact that it assists one in identifying relationships between several elements or variables that exist in a problem situation. The design principles that are associated with the system analysis are also helpful. These principles are:

- Elements in any system are designed to maximize the output of the system.
- A system is designed to handle the conditions that typically occur.
- Each system is a part of a larger system.
- Feasible targets needs to be established for system improvement.

In research, a systems analysis is helpful in identifying the independent and dependent variables in a problem situation. It is also very helpful in identifying potential confounding variables that need to be considered in the research design.

The systems analysis shown in Figure 1 is based on an actual problem situation from industry.

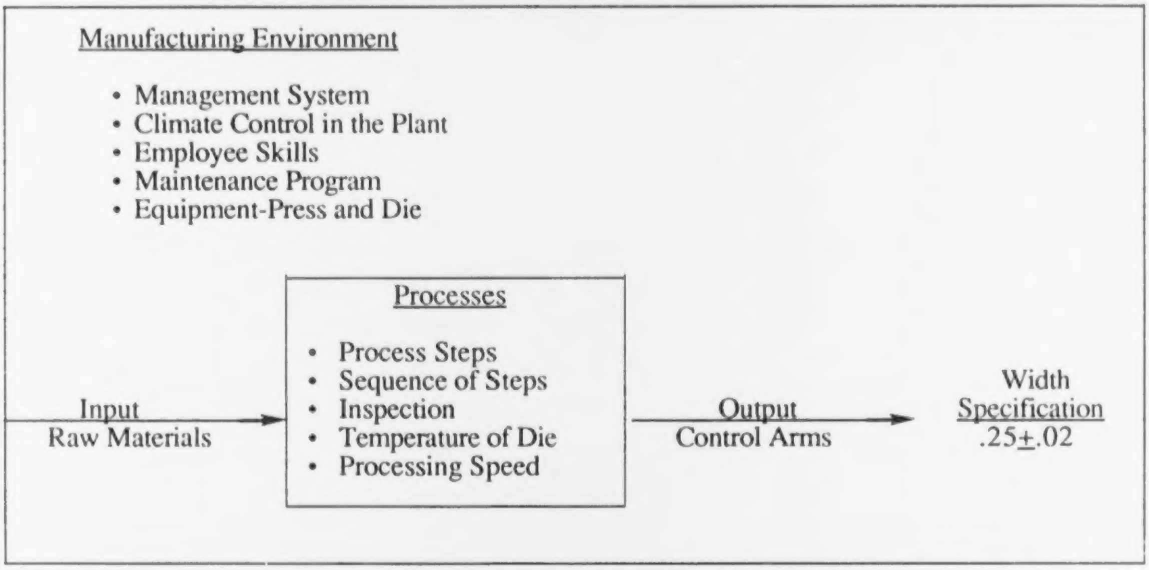
Manufacturing Environment
• Management System
• Climate Control in the Plant
• Employee Skills
• Maintenance Program
• Equipment-Press and Die
Processes
• Process Steps
• Sequence of Steps
• Inspection
• Temperature of Die
• Processing Speed
Input
Raw Materials
Output
Control Arms
Width
Specification
.25±.02

Figure 1: Systems Analysis Diagram

Systems Analysis Process

The steps to complete a systems analysis are:

1. Identify where the problem occurs.
2. Determine what system(s) are involved.
3. Complete a systems analysis on the system(s) involved. (CIPP)
   a. Identify the purpose of the system
   b. Describe the outputs or products of the system
   c. List and describe the inputs
   d. List the processes and their sequence
   e. Define the environment or context within which the system functions
4. Study or review the system to determine what element(s) need(s) to be changed to improve the performance of the system.
   a. Analyze current records and data on the system
   b. Conduct experiments on the system

PROBLEM SOLVING IN BUSINESS AND INDUSTRY

Prepared by

Orville Nelson

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Problem Solving In Business and Industry

Several factors have stimulated B/I to take an increased interest in problem solving. The global marketplace with its demand for quality products and flexible responses to customers' needs has had a major impact. All quality programs have some type of problem-solving or error cause removal (ECR) component. Several of the problem-solving techniques in this handbook were developed by quality practitioners.

The need for high quality, lower costs and more flexibility has led to a flattening of corporate management structures. More emphasis is being placed on self-managed work teams and giving responsibility for problem solving to employees in work centers. Group problem-solving techniques, flow charts, cause-effect diagrams, and system analysis were identified as some of the most frequently used techniques in our survey of training directors and manufacturing managers.

During visits to industry, Center and project staff members have observed the growing importance of problem solving. We have seen fish-bone charts, Pareto Diagrams, and a variety of other techniques used. Many companies are using designed experiments to quantify factors that influence their processes and the quality of their products. In the last year to eighteen months, service industries have become much more concerned about quality and interested in problem solving.

Problem-Solving Process

There is a growing volume of literature on problem solving. Several different problem-solving systems have been developed. Many of these systems follow the general pattern of steps described by John Dewey. This is sometimes called the Scientific Method. It is:

1. Recognize Problem
2. Define Problem
3. Formulate Hypotheses (Tentative Solutions)
4. Collect Data
5. Analyze Data (Test Hypotheses)
6. State Conclusions (Confirm or Disconfirm Hypotheses)

There are variations on this set of steps; however, all problem-solving strategies start with recognition of a problem and the further definition of the problem. Next, the problem situation is analyzed to determine the important variables and one or more tentative solutions are developed. These solutions are tested to determine which ones are valid and most effective.

Cause-Effect

Pareto Diagrams can be used to isolate critical problems. Cause-effect diagrams, fish-bone diagrams, and systems analysis are utilized to identify potential causes. These are useful tools; however, problem solving goes beyond these.

In problem solving, we are interested in determining how variables effect each other. The purpose of problem solving is to determine what factors cause the problem. In other words, cause is a variable or factor that influences the characteristics of another variable. The relationship between cause and effect is shown below. It is important to note that the cause will always occur before the effect.

Cause → Effect

Therefore, the search for causes should be focused in the time period prior to the problem.

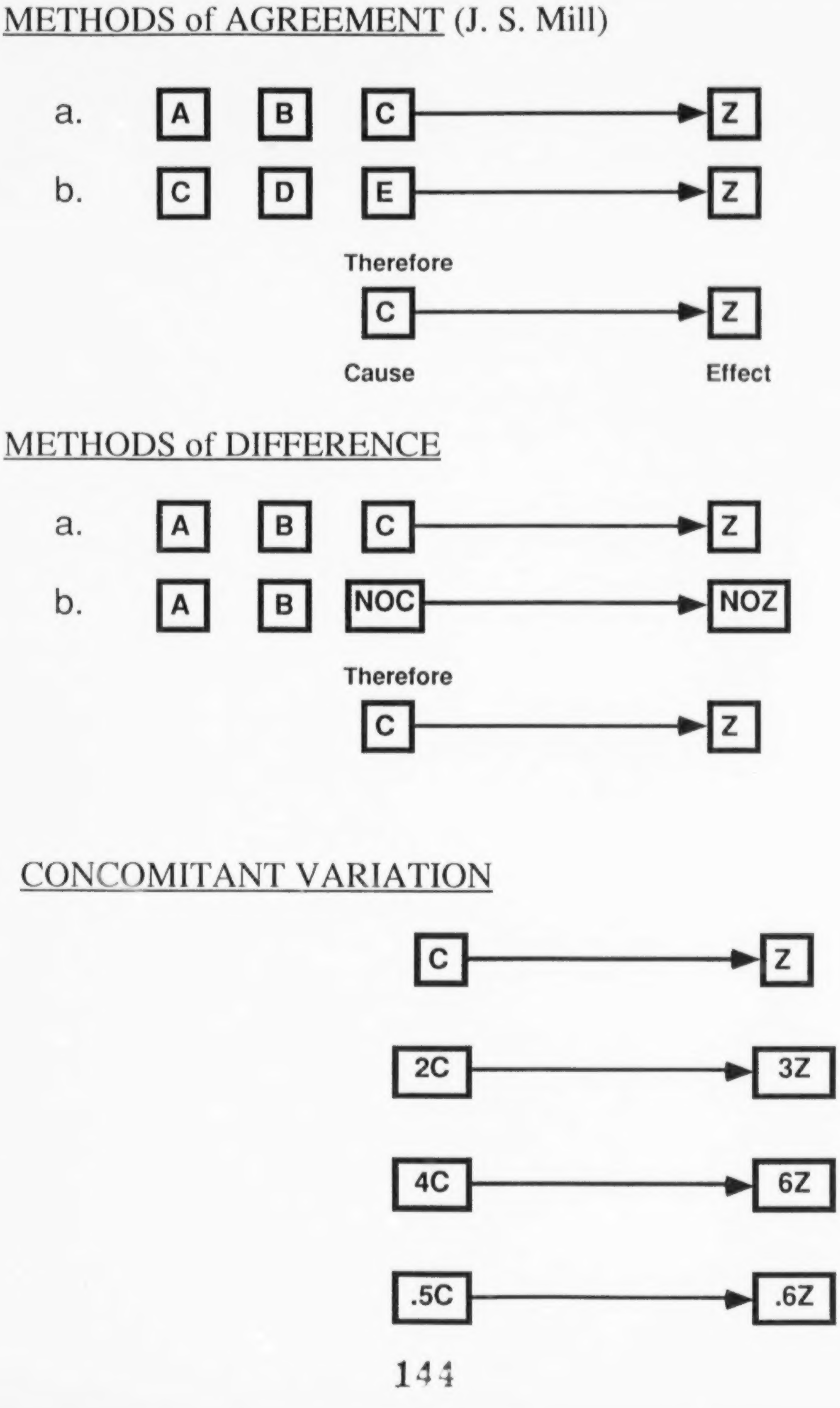
In some respects this sounds simple. In real life; however, the process of identifying potential causes and validating them can be very challenging.

Logic

Three logical thinking processes that are useful are shown in Figure 1. The method of agreement concludes that C causes Z when C is the only common element in the two situations. In the method of difference, C appears only in situation a. If Z occurs only in situation A, C is the cause of Z. The method of difference is a stronger test of the relationship between C and Z.

The strongest test of a cause-effect relationship is concomitant variation. In this test, the value of C is varied to determine the impacts on Z. A classic example of this is the Hawthorne Experiment done at General Electric. Lighting levels were increased in a work area to determine the effect on productivity. After the first increase, productivity increased. Another increase in illumination was followed by another increase in productivity. However, when the illumination level was reduced productivity increased again. The concomitant variation test was failed and the researchers had to look for another cause.

Figure 1



METHODS of AGREEMENT (J. S. Mill)

METHODS of DIFFERENCE

CONCOMITANT VARIATION

a.
A
B
C
Z
b.
C
D
E
Z
Therefore
C
Z
Cause
Effect
a.
A
B
C
Z
b.
A
B
NOC
NOZ
Therefore
C
Z
C
Z
2C
3Z
4C
6Z
.5C
.6Z

Creativity

Creativity is the ability to develop unique solutions or responses. It involves combining seemingly different elements into new or unique solutions. Some techniques that facilitate creativity are:

- Brainstorming
- SCAMPER
  - → Substitute
  - → Combine
  - → Adopt
  - → Modify
  - → Magnify
  - → Minify

Students need to to be encouraged to be creative. They should be involved in brainstorming activities, both in groups and individually. They should be encouraged to try different approaches and solutions.

References

Emory, C. W. (1985). Business Research Methods. Homewood, Illinois: Richard D. Irwin, Inc.
Osborne, A.E. (1963). Applied Imagination. New York: Scribners.
Von Oech, R.A. (1983). A Whack on the Side of the Head. New York: Warner.

DESIGNED EXPERIMENTS

Prepared by

Orville Nelson

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Designed Experiments

Introduction

Problem solvers and researchers are usually cautioned that "correlation does not mean causation." Typically we want to identify the cause of a problem so the cause can be corrected and the problem eliminated. Problem-solving tools such as cause-effect diagrams, fish-bone diagrams, and scatter diagrams are very helpful in analyzing a situation and identifying potential causes. However, they do not prove that there is a cause-effect linkage between a variable and a problem.

An experiment must be done in order to prove a cause-effect relationship. An experiment involves the purposeful manipulation of one or more variables, potential causes, to determine the impact on another variable.

Designed Experiments

Designed experiments are used in business and industry to improve processes, enhance quality, and reduce defects. One or more independent variables are manipulated and the effects on one or more dependent variables are measured. Typically, several factors influence the quality of a process or product. Thus, designed experiments usually involve several independent variables. However, the basic concepts used in designing a complex study are the same as those utilized in designing a simple, one factor, study.

Concepts Used In Experiments

The following concepts are used in experimental studies. In order to give more meaning to these definitions, I am going to use the example of an experiment with a training program. The XYZ Corporation is training its employees to use statistics in controlling processes. XYZ trainers wonder if instruction with PCs or pocket calculators will be more effective. They decide to conduct an experiment. From one department that has thirty employees, fifteen are randomly assigned to the PC method, and fifteen are randomly assigned to the calculator method. Both groups receive the same training content and the amount of training time is held constant. At the end of the training period, both groups take the same test. The test measures the trainees' ability to calculate and interpret statistics. After the tests are completed, they are scored and the scores for the two groups are compared. The results from this comparison are used to decide which method is more effective.

Now let us look at the concepts involved in this study.

- Variable - Characteristics or factors that can have two or more values.
- Special types of variables

  Independent Variable (IV) - Factor that influences or causes changes in the dependent variable. (In the example this is the learning equipment: PCs vs. calculators.)

  Dependent Variable (DV) - Factor that is influenced by the independent variable. (In the example this is the trainees' ability to calculate and interpret statistics.)

  Extraneous Variable (EV) - Factor that could influence the outcome of the study (DV) if it is not controlled in some way. (Intelligence or previous training could effect the outcome of the training study. Random assignment of trainees was used to "control" or balance these factors.)

The relationship between independent and dependent variable is:

IV → DV

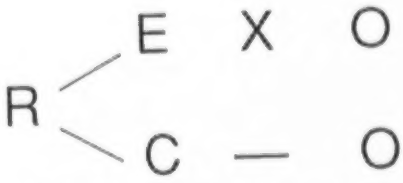
(Cause) → (Effect)

The problem will define the DV. A fish-bone diagram, systems analysis or scatter diagram can be used to identify the IV. Usually these techniques will generate more than one potential IV. The researcher will have to select the independent variables for a given study.

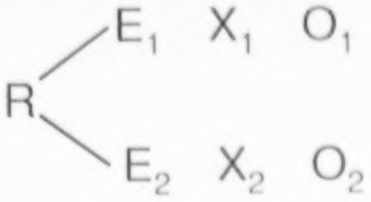
The following symbols are used to describe an experimental design.

X= Treatment
O= Observation
R= Random assignment
E=Experimental group
C=Control group

A one factor design, such as in the example, would be defined in the following way. This design



indicates that people are randomly assigned to experimental and control groups. The experimental group receives the treatment and the control group does not receive the treatment. Both groups are assessed or tested at the end of the experiment. In our example, both groups receive a treatment, therefore, the design could be shown in the following way.



Analysis of Results

A statistical analysis and significance test will be run on the data from the observations. In a study such as the example, a t test would probably be used. In complex experiments, more sophisticated analyses are used. Usually companies will have someone with statistical research design expertise select the design and statistical analyses to use. Employees need to understand the role of experimental research, the reasons for careful design and control, and use of probability in determining the outcome of a study.

Steps in Designing an Experiment

The following set of steps is usually involved in designing a study.

1. Identify or isolate a problem.
   (Pareto Diagram.)
2. Define the problem.
   - Topic
   - Scope
   - End product or goal
3. Develop hypotheses. Hypotheses are tentative solutions and state something about the variables in the study. In an experimental study the hypotheses will usually deal with cause-effect relationships. (Fish-bone diagrams, systems analysis, or scatter diagrams can be used to identify tentative relationships.)
4. Collect data to test the hypotheses.
   a. Design an experiment to test the null hypothesis
   b. Develop valid and reliable instruments
   c. Conduct the experiment
   d. Collect data
5. Analyze the data.
6. State conclusions. Decide if the null hypothesis should be accepted.

Other Designs

In some situations it is not possible to conduct a true experimental design. However, care must be taken in conducting the study to minimize the effects of factors, other than the independent variables, that may influence the dependent variable.

Time Series

A time series design is a "before and after" comparison. For example, a department may have a problem that generates a specific type of defect. It is not feasible to run a designed experiment since the department is small.

An alternative design is to record the performance level prior to the "experimental treatment." The treatment might be a training program or a new set of procedures. After the treatment, performance levels are measured and compared with the pre-treatment levels. If there is a significant difference, the treatment was effective.

The problem with this design, as contrasted with an experimental design, is that other factors may influence the outcome. For example, other changes may be made while the treatment is being completed.

One way to minimize the possibility of coming to a wrong conclusion is to monitor what is happening in the department or setting where the study is being conducted. Determine if there are any other changes that were made that could have caused the outcome. In designed experiments, the simplest and most logical solution would win out.

Reference

Emlory, C. William (1985) Business Research Methods. Homewood, Ill. Richard D. Irwin,Inc.

Gourmet Peanuts

1. Sample Code ____________

Directions: Eat a portion of the sample of peanuts given to you. Complete the items that follow. The left hand column contains a set of characteristics that are to be evaluated. Use the following ratings.

1=VP=Very Poor
2= P=Poor
3= A=Acceptable
4= G=Good
5=VG=Very Good

Characteristics	Ratings				
	VP 1	P 2	A 3	G 4	VG 5
2. Appearance	1	2	3	4	5
3. Aroma	1	2	3	4	5
4. Crispiness	1	2	3	4	5
5. Chewability	1	2	3	4	5
6. Flavor	1	2	3	4	5
7. After Taste	1	2	3	4	5
8. Ease of Eating	1	2	3	4	5
9. Overall Evaluation of Product	1	2	3	4	5

TOTAL SCORE (Sum the numeric values of the responses you have circled and place that value in the space provided.) ____________

Comments:

```
DISAP, Version 2.0,  VAX-11 BASIC. Program: LIK104                 Page: 1
Analysis on 30-Apr-91 at 04:47 PM.  Data from file 'PEANUTS_A91' with a total
of 15 people and 9 questions.  There are presently 15 people in the BASE group
and 8 questions being processed.  Group numbers based on the Primary group.


******************************************************************************
Group: Base
--------------------

------------------------------------------------------------------------------

Record   Score
                Omits  1    2    3    4    5
    1       9   0.13 0.63 0.25
    2      30   0.00 0.00 0.13 0.25 0.38 0.25
    3      20   0.00 0.00 0.63 0.25 0.13
    4      25   0.00 0.00 0.13 0.63 0.25
    5      38   0.00 0.00 0.00 0.13 0.00 0.88
    6      36   0.00 0.00 0.00 0.13 0.25 0.63
    7      21   0.00 0.00 0.50 0.38 0.13
    8      20   0.00 0.13 0.50 0.25 0.00 0.13
    9      28   0.00 0.00 0.13 0.38 0.38 0.13
   10      30   0.00 0.00 0.00 0.50 0.25 0.25
   11      27   0.00 0.13 0.13 0.13 0.50 0.13
   12      14   0.00 0.38 0.50 0.13
   13      21   0.00 0.00 0.38 0.63
   14      27   0.00 0.00 0.25 0.25 0.38 0.13
   15      23   0.00 0.00 0.50 0.25 0.13 0.13
------------------------------------------------------------------------------

Record       Name          Score Percent Rank   %-tile  z-score  T-score

   1 1                         9  0.22  15.00    3.00   -2.10    29.00
   2 2                        30  0.75   3.50   80.00    0.70    57.00
   3 3                        20  0.50  12.50   20.00   -0.60    44.00
   4 4                        25  0.63   8.00   50.00    0.10    51.00
   5 5                        38  0.95   1.00   96.00    1.80    68.00
   6 6                        36  0.90   2.00   90.00    1.50    65.00
   7 7                        21  0.52  10.50   33.00   -0.50    45.00
   8 8                        20  0.50  12.50   20.00   -0.60    44.00
   9 9                        28  0.70   5.00   70.00    0.50    55.00
  10 10                       30  0.75   3.50   80.00    0.70    57.00
  11 11                       27  0.68   6.50   60.00    0.30    53.00
  12 12                       14  0.35  14.00   10.00   -1.40    36.00
  13 13                       21  0.52  10.50   33.00   -0.50    45.00
  14 14                       27  0.68   6.50   60.00    0.30    53.00
  15 15                       23  0.57   9.00   43.00   -0.20    48.00
```

```
DISAP, Version 2.0,  VAX-11 BASIC. Program: LIK106              Page: 2
Analysis on 30-Apr-91 at 04:47 PM.  Data from file 'PEANUTS_A91' with a total
of 15 people and 0 questions.  There are presently 15 people in the BASE group
and 8 questions being processed.  Group numbers based on the Primary group.


--------------------
Item analysis
--------------------
Item   ---- Mean ----   -- Stand Dev --           item    ------ Quartile ------
        Omit  No omit     Omit   No omit   Number P-cor   First Median Third IQR
   2    2.60    2.60      0.91     0.91       15   0.72   1.92   2.33  3.06  1.15

Omits    1    2    3    4    5
 0.00 0.00 0.60 0.27 0.07 0.07
    0    0    9    4    1    1

Item   ---- Mean ----   -- Stand Dev --           item    ------ Quartile ------
        Omit  No omit     Omit   No omit   Number P-cor   First Median Third IQR
   3    2.20    2.20      0.77     0.77       15   0.61   1.63   2.25  2.88  1.25

Omits    1    2    3
 0.00 0.20 0.40 0.40
    0    3    6    6

Item   ---- Mean ----   -- Stand Dev --           item    ------ Quartile ------
        Omit  No omit     Omit   No omit   Number P-cor   First Median Third IQR
   4    3.93    4.21      1.44     0.97       15   0.76   3.63   4.50  5.00  1.38

Omits    1    2    3    4    5
 0.07 0.00 0.07 0.13 0.27 0.47
    1    0    1    2    4    7

Item   ---- Mean ----   -- Stand Dev --           item    ------ Quartile ------
        Omit  No omit     Omit   No omit   Number P-cor   First Median Third IQR
   5    3.33    3.33      1.23     1.23       15   0.86   2.61   3.14  4.56  1.96

Omits    1    2    3    4    5
 0.00 0.07 0.13 0.47 0.07 0.27
    0    1    2    7    1    4

Item   ---- Mean ----   -- Stand Dev --           item    ------ Quartile ------
        Omit  No omit     Omit   No omit   Number P-cor   First Median Third IQR
   6    3.07    3.07      1.16     1.16       15   0.90   2.19   3.00  3.92  1.73

Omits    1    2    3    4    5
 0.00 0.07 0.27 0.33 0.20 0.13
    0    1    4    5    3    2

Item   ---- Mean ----   -- Stand Dev --           item    ------ Quartile ------
        Omit  No omit     Omit   No omit   Number P-cor   First Median Third IQR
   7    3.13    3.13      1.06     1.06       15   0.78   2.42   3.20  3.95  1.53

Omits    1    2    3    4    5
 0.00 0.07 0.20 0.33 0.33 0.07
    0    1    3    5    5    1
```

```
DISAP, Version 2.0,  VAX-11 BASIC. Program: LIK106                Page: 3
Analysis on 30-Apr-91 at 04:47 PM.  Data from file 'PEANUTS_A91' with a total
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and 8 questions being processed.  Group numbers based on the Primary group.

Item   ---- Mean ----   -- Stand Dev --          item   ------ Quartile ------
        Omit  No omit     Omit   No omit   Number P-cor  First Median Third IQR
   8    3.40    3.40      1.40     1.40       15   0.86  2.38   3.63  4.56  2.19

Omits    1    2    3    4    5
 0.00 0.13 0.13 0.20 0.27 0.27
    0    2    2    3    4    4

Item   ---- Mean ----   -- Stand Dev --          item   ------ Quartile ------
        Omit  No omit     Omit   No omit   Number P-cor  First Median Third IQR
   9    2.93    2.93      1.33     1.33       15   0.95  1.85   2.75  4.06  2.21

Omits    1    2    3    4    5
 0.00 0.13 0.33 0.13 0.27 0.13
    0    2    5    2    4    2

==============================================================================
                         Likert component calculations

     Source:              Degrees             Sum            Mean
                            of                of              of
                          Freedom           Squares        Squares
Among Individuals          14              102.2000         7.3000
      Among Items           7               28.8583         4.1226
         Residual          98               55.2667         0.5639

            TOTAL         119              186.3250         1.5658

------------------------------------------------------------------------------
 ------- Reliability -------  Standard error  Mean   Standard    Average
 Hoyt's        Spearman-Brown of measurement  score  deviation   response
  0.92             0.94           2.1240      24.60    7.64        3.08
==============================================================================

------------------------------
Ranking of the items.
------------------------------
---- Rank ----                          Standard        Number of
 Mean     Score        Item    Mean   Deviation Score respondents
  7.00     7.00          2     2.60      0.91     39      15
  8.00     8.00          3     2.20      0.77     33      15
  1.00     1.00          4     4.21      0.97     59      14
  3.00     3.00          5     3.33      1.23     50      15
  5.00     5.00          6     3.07      1.16     46      15
  4.00     4.00          7     3.13      1.06     47      15
  2.00     2.00          8     3.40      1.40     51      15
  6.00     6.00          9     2.93      1.33     44      15
```

```
MTB > set c2
DATA> 25
DATA> 24 18 13 22 22 20 18 19
DATA> 18 30 26 20 16 21
DATA> end
MTB > prin c1 c2   HOT
 ROW    C1    C2
                        REGULAR
   1     9    25
   2    30    24
   3    20    18
   4    25    13
   5    38    22
   6    36    22
   7    21    20
   8    20    18
   9    28    19
  10    30    18
  11    27    30
  12    14    26
  13    21    20
  14    27    16
  15    23    21

MTB >
```

```
ANALYSIS OF VARIANCE
SOURCE     DF         SS         MS        F
FACTOR      1      108.3      108.3     2.83
ERROR      28     1072.0       38.3
TOTAL      29     1180.3
                                   INDIVIDUAL 95 PCT CI'S FOR MEAN
                                   BASED ON POOLED STDEV
LEVEL       N       MEAN     STDEV --+---------+---------+---------+----
regular    15      24.60      7.64              (----------*----------)
hot        15      20.80      4.26 (----------*----------)
                                   --+---------+---------+---------+----
POOLED STDEV =  6.19              18.0      21.0      24.0      27.0
MTB >
MTB >
MTB > twosample t 0 95 c1 c2

TWOSAMPLE T FOR regular VS hot
          N      MEAN     STDEV   SE MEAN
regular  15     24.60      7.64       2.0
hot      15     20.80      4.26       1.1

95 PCT CI FOR MU regular - MU hot: (-0.9, 8.5)
TTEST MU regular = MU hot (VS NE): T=1.68 P=0.11 DF=21.9

MTB >
```

```
  regular

   MIDDLE OF    NUMBER OF
   INTERVAL     OBSERVATIONS
         10         1     *
         15         1     *
         20         4     ****
         25         4     ****
         30         3     ***
         35         1     *
         40         1     *

MTB >
```

```
   hot

    MIDDLE OF    NUMBER OF
    INTERVAL     OBSERVATIONS
          13         1     *
          14         0
          15         0
          16         1     *
          17         0
          18         3     ***
          19         1     *
          20         2     **
          21         1     *
          22         2     **
          23         0
          24         1     *
          25         1     *
          26         1     *
          27         0
          28         0
          29         0
          30         1     *

  MTB >
```

```
DATA> 4 3 5 5 5 4 5 5
DATA> 2 3 4 3 2 2 3 2
DATA> 2 2 5 3 3 2 1 2
DATA> 2 3 4 3 4 4 5 3
DATA> 3 3 5 5 3 3 4 4
DATA> 2 1 5 3 4 4 4 4
DATA> 2 1 2 1 2 3 2 1
DATA> 3 3 3 2 3 3 2 2
DATA> 2 2 3 4 3 4 5 4
DATA> 2 2 5 3 2 4 3 2
DATA> end
    15 ROWS READ
MTB > corr c1 c3-c10

         regular      C3      C4      C5      C6      C7      C8      C9
C3          .725
C4          .606    .527
C5          .758    .360    .462
C6          .863    .636    .523    .657
C7          .903    .702    .460    .644    .680
C8          .783    .503    .313    .522    .455    .745
C9          .861    .469    .447    .510    .701    .726    .777
C10         .950    .682    .428    .630    .882    .878    .714    .854

MTB >
```

```
MTB > plot c1 c10
          regular
           44.00+
                -
                -                                         *
                -                                         *
                -
           31.00+                               2
                -                     *
                -                     *         2
                -           *
                -           4
           18.00+
                -
                - *
                - *
                -
            5.00+
                  +---------+---------+---------+---------+---------+C10
                1.00      2.00      3.00      4.00      5.00      6.00

MTB >
MTB >
MTB > plot c4 c10
              C4
           3.60+
               -
               -
               -          2         *         *         2
               -
           2.70+
               -
               -
               -
               -          3         *         2
           1.80+
               -
               -
               -
               - 2                            *
            .90+
                 +---------+---------+---------+---------+---------+C10
               1.00      2.00      3.00      4.00      5.00      6.00

MTB >
MTB >
```

```
MTB >
MTB > plot c7 c8
              C7
           5.50+
               -
               -
               -                              *         *
               -
           4.00+                    *         2
               -
               -
               -          *         3         *
               -
           2.50+
               -
               -          2         *         *
               -
               -
           1.00+ *
                 +---------+---------+---------+---------+---------+C8
               1.00      2.00      3.00      4.00      5.00      6.00

MTB >
```

HOT

↓

```
DISAP, Version 2.0,  VAX-11 BASIC. Program: LIK104                Page: 1
Analysis on 30-Apr-91 at 04:49 PM.  Data from file 'PEANUTS_B91' with a total
of 15 people and 9 questions.  There are presently 15 people in the BASE group
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*******************************************************************************
Group: Base
--------------------

-------------------------------------------------------------------------------

Record   Score
                Omits  1    2    3    4    5
   1      25    0.00 0.13 0.00 0.63 0.13 0.13
   2      24    0.00 0.00 0.50 0.13 0.25 0.13
   3      18    0.00 0.13 0.50 0.38
   4      13    0.00 0.38 0.63
   5      22    0.00 0.00 0.50 0.25 0.25
   6      22    0.00 0.13 0.50 0.00 0.25 0.13
   7      20    0.00 0.00 0.50 0.50
   8      18    0.00 0.25 0.50 0.00 0.25
   9      19    0.00 0.00 0.63 0.38
  10      18    0.00 0.00 0.88 0.00 0.13
  11      30    0.00 0.00 0.00 0.38 0.50 0.13
  12      26    0.00 0.00 0.13 0.63 0.13 0.13
  13      20    0.00 0.00 0.75 0.13 0.00 0.13
  14      16    0.00 0.25 0.63 0.00 0.13
  15      21    0.00 0.25 0.25 0.25 0.13 0.13
-------------------------------------------------------------------------------

Record       Name          Score Percent Rank    %-tile  z-score  T-score

  1 1                        25   0.63    3.00    83.00    1.00     60.00
  2 2                        24   0.60    4.00    76.00    0.80     58.00
  3 3                        18   0.45   12.00    23.00   -0.70     43.00
  4 4                        13   0.32   15.00     3.00   -1.90     31.00
  5 5                        22   0.55    5.50    66.00    0.30     53.00
  6 6                        22   0.55    5.50    66.00    0.30     53.00
  7 7                        20   0.50    8.50    46.00   -0.20     48.00
  8 8                        18   0.45   12.00    23.00   -0.70     43.00
  9 9                        19   0.47   10.00    36.00   -0.40     46.00
 10 10                       18   0.45   12.00    23.00   -0.70     43.00
 11 11                       30   0.75    1.00    96.00    2.20     72.00
 12 12                       26   0.65    2.00    90.00    1.30     63.00
 13 13                       20   0.50    8.50    46.00   -0.20     48.00
 14 14                       16   0.40   14.00    10.00   -1.20     38.00
 15 15                       21   0.52    7.00    56.00    0.00     50.00
```

```
DISAP, Version 2.0,  VAX-11 BASIC. Program: LIK106                 Page: 2
Analysis on 30-Apr-91 at 04:49 PM.  Data from file 'PEANUTS_B91' with a total
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and 8 questions being processed.  Group numbers based on the Primary group.


--------------------
Item analysis
--------------------
Item   ---- Mean ----   -- Stand Dev --              item   ------ Quartile ------
       Omit  No omit     Omit   No omit    Number P-cor  First Median Third IQR
   2   2.73     2.73     0.80      0.80        15   0.57  2.04  2.60  3.35  1.31

Omits    1    2    3    4
 0.00 0.00 0.47 0.33 0.20
    0    0    7    5    3

Item   ---- Mean ----   -- Stand Dev --              item   ------ Quartile ------
       Omit  No omit     Omit   No omit    Number P-cor  First Median Third IQR
   3   2.40     2.40     0.91      0.91        15   0.61  1.75  2.29  3.06  1.31

Omits    1    2    3    4
 0.00 0.13 0.47 0.27 0.13
    0    2    7    4    2

Item   ---- Mean ----   -- Stand Dev --              item   ------ Quartile ------
       Omit  No omit     Omit   No omit    Number P-cor  First Median Third IQR
   4   3.67     3.67     1.35      1.35        15   0.69  2.69  3.75  4.88  2.19

Omits    1    2    3    4    5
 0.00 0.07 0.13 0.27 0.13 0.40
    0    1    2    4    2    6

Item   ---- Mean ----   -- Stand Dev --              item   ------ Quartile ------
       Omit  No omit     Omit   No omit    Number P-cor  First Median Third IQR
   5   2.67     2.67     0.90      0.90        15   0.50  1.96  2.60  3.35  1.39

Omits    1    2    3    4
 0.00 0.07 0.40 0.33 0.20
    0    1    6    5    3

Item   ---- Mean ----   -- Stand Dev --              item   ------ Quartile ------
       Omit  No omit     Omit   No omit    Number P-cor  First Median Third IQR
   6   2.40     2.40     0.99      0.99        15   0.75  1.72  2.19  3.13  1.41

Omits    1    2    3    4
 0.00 0.13 0.53 0.13 0.20
    0    2    8    2    3

Item   ---- Mean ----   -- Stand Dev --              item   ------ Quartile ------
       Omit  No omit     Omit   No omit    Number P-cor  First Median Third IQR
   7   1.93     1.93     0.80      0.80        15   0.63  1.44  1.89  2.31  0.87

Omits    1    2    3    4
 0.00 0.27 0.60 0.07 0.07
    0    4    9    1    1
```

```
DISAP, Version 2.0,  VAX-11 BASIC. Program: LIK106                    Page: 3
Analysis on 30-Apr-91 at 04:49 PM.  Data from file 'PEANUTS_B91' with a total
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and 8 questions being processed.  Group numbers based on the Primary group.

Item   ---- Mean ----   -- Stand Dev --              item    ------ Quartile ------
        Omit  No omit     Omit   No omit    Number P-cor  First Median Third IQR
   8    2.73    2.73      1.03     1.03        15    0.07  1.96  2.60  3.35  1.39

Omits    1    2    3    4    5
 0.00 0.07 0.40 0.33 0.13 0.07
    0    1    6    5    2    1

Item   ---- Mean ----   -- Stand Dev --              item    ------ Quartile ------
        Omit  No omit     Omit   No omit    Number P-cor  First Median Third IQR
   9    2.27    2.27      0.70     0.70        15    0.80  1.77  2.15  2.58  0.81

Omits    1    2    3    4
 0.00 0.07 0.67 0.20 0.07
    0    1   10    3    1

==============================================================================
                         Likert component calculations

    Source:            Degrees              Sum           Mean
                         of                  of             of
                       Freedom             Squares        Squares
Among Individuals        14                31.8000        2.2714
      Among Items         7                27.2000        3.8857
         Residual        98                69.8000        0.7122

            TOTAL       119               128.8000        1.0824

------------------------------------------------------------------------------
 ------- Reliability -------  Standard error  Mean   Standard    Average
 Hoyt's       Spearman-Brown  of measurement  score  deviation   response
  0.69            0.80             2.3870     20.80    4.26        2.60
==============================================================================

------------------------------
Ranking of the items.
------------------------------
---- Rank ----                        Standard         Number of
 Mean      Score         Item   Mean  Deviation Score  respondents
  2.50      2.50           2    2.73     0.80      41       15
  6.00      5.50           3    2.40     0.91      36       15
  1.00      1.00           4    3.67     1.35      55       15
  4.00      4.00           5    2.67     0.90      40       15
  5.00      5.50           6    2.40     0.99      36       15
  8.00      8.00           7    1.93     0.80      29       15
  2.50      2.50           8    2.73     1.03      41       15
  7.00      7.00           9    2.27     0.70      34       15
```

EVALUATING PROBLEM-SOLVING SKILLS

Prepared by

Orville Nelson

VTAE Problem-Solving Workshop

Center for Vocational, Technical and Adult Education

April 29-30, and May 1, 1991
University of Wisconsin-Stout
Menomonie, WI 54751

Evaluating Problem-Solving Skills

Evaluation is an important part of instruction. The evaluation strategies and techniques used will have a significant impact on what students study and the competencies they acquire. If tests emphasize memory and the recall of facts and formulas, students will study these and commit them to memory. They will be able to answer factual test questions, but they may not be able to use this information in solving problems.

In the language of test developers, your test questions must be valid. In other words, they must measure the competencies that you want to measure. In order to obtain a valid assessment of student's problem-solving competencies, you will need to select the appropriate measurement techniques. One tool that I have found helpful in this process is Bloom's Taxonomy for the Cognitive Domain (1956). The six levels in Bloom's taxonomy are shown in Figure 1 that follows.

A taxonomy is organized in a hierarchical structure. It has elements or components that are organized in a sequence. For example, six different types of cognitive activity are identified in the taxonomy for the cognitive domain. The first level is **knowledge**, the second level is **comprehension**, and the third level is **application**. Since that is a taxonomy, the sequence is also important. This sequence indicates that knowledge is the basis for higher level activities. The structure also indicates that in order to have comprehension you must have knowledge. Furthermore, to apply or solve simple problems, a person must have certain areas of knowledge and comprehend them sufficiently to be able to apply this knowledge to a practical situation.

The taxonomy for the cognitive domain is useful in that it suggests the types of cognitive capabilities that are required to solve problems. A problem that has some complexity will require a level five, **synthesis**, type of cognitive activity to solve it. Synthesis involves taking the various elements of a problem situation and coming up with a new configuration that resolves the problem involved. It involves developing a new product or solution. In order to do this one also must be able to analyze the problem into its component parts, the **analysis** level in the taxonomy. In order to do the analysis the problem solver must have knowledge, comprehend this knowledge and be able to apply it to new situations.

By this time it should be apparent that to test problem-solving ability, one must provide the student with a unique or new situation. Otherwise, the student could rely on memory to come up with an appropriate answer.

Figure 1: Cognitive Taxonomy

6. Evaluation

- External Evidence
- Internal Evidence

5. Synthesis

- Abstract Relationships
- Develop a Plan
- Unique Communication

4. Analysis

- Organizational Principles
- Relationships
- Elements

3. Application

2. Comprehension

- Extrapolation
- Interpretation
- Translation

1. Knowledge

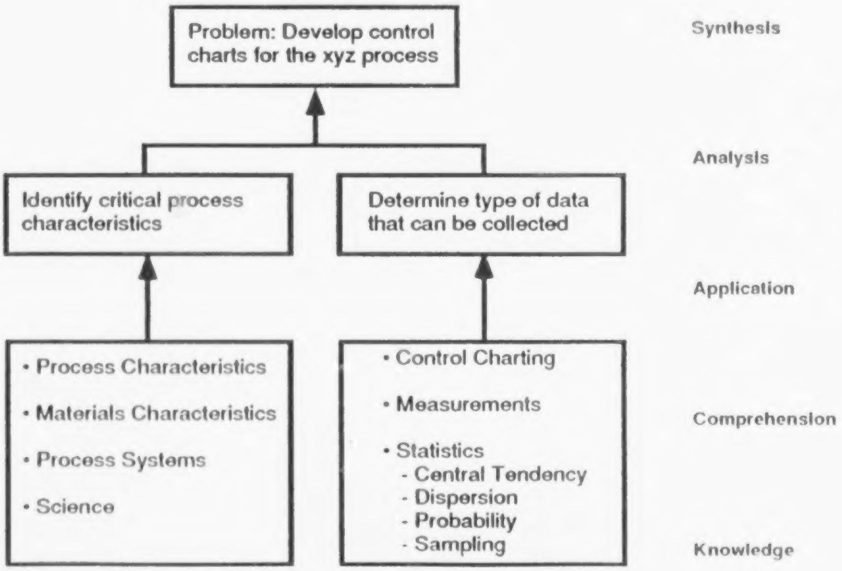
- Principles, Models and Theories
- Conventions, Criteria and Methods
- Specifics

Two frequently raised questions are: (1) what is the difference between applications and synthesis? and, (2) do you need to know everything there is to know in order to solve problems? Let us look at the difference between analysis and synthesis first. Analysis does involve he solution of simple problems. However, the type of capability required is that of applying a concept or technique to a fairly specific situation. For instance, after studying the statistics required in statistical process control, an instructor would probably develop sample sets of data and ask students to calculate the mean and standard deviation for each set. If the students had not seen these sets of data before, this would be an activity that requires application skills. These same competencies would be linked with several others to operate at the synthesis level when student are given an assignment to study a process, define the characteristics to be monitored, describe the data to be collected, identify the sampling plan and create a sample of the control charts to be used.

At this point let us turn to the second question which is concerned with the amount of information or knowledge that one has to have in order to do a synthesis level activity. In the SPC example given earlier, will the person need to be an accomplished statistician? My answer is "no." The person will need to know the statistical concepts required to solve the problem.

The next step is to determine what areas of knowledge are actually required to solve a problem. One way to approach this is to take a look at he problem or problems that need to be solved on a job and identify the areas of knowledge involved. In the example given above, the areas of knowledge listed in Figure 2 would likely be involved.

Figure 2: Problem Analysis



Problem: Develop control charts for the xyz process
Synthesis
Analysis
Identify critical process characteristics
Determine type of data that can be collected
Application
• Process Characteristics
• Materials Characteristics
• Process Systems
• Science
• Control Charting
• Measurements
• Statistics
- Central Tendency
- Dispersion
- Probability
- Sampling
Comprehension
Knowledge

Selected tools and techniques that can be used at each level in the cognitive taxonomy are listed in Figure 3. Pareto Diagrams and histograms can be used to acquire and organize knowledge in a problem area. Cause-effect diagrams, systems analysis, and PERT diagrams provide techniques for determining the factors, elements or variables in a problem situation. Designed experiments evaluate the validity of hypothesized cause-effect relationships.

Figure 3: Cognitive Taxonomy, Tools and Techniques

Taxonomy Levels	Tools and Techniques
6. Evaluation	• Designed Experiments
5. Synthesis	• Systems Design
4. Analysis	• Cause-Effect Diagrams • Systems Analysis • Flow Charts • PERT Diagrams • MATRIX
3. Application	
2. Comprehension	
1. Knowledge	• Pareto Diagrams • Histograms

Evaluation techniques that can be used to each level in the taxonomy are given in Figure 4. Knowledge and comprehension can be evaluated with traditional test items. Higher levels, application through evaluation, require problem or situational-based test exercises.

Gronlund (1985) presents the interpretive exercise as one technique that can be employed to assess higher level cognitive competencies. An interpretive exercise consists of a set of data and a series of test items. The same set of data is given to all students; thus, they all have the same task. See Figure 5. The amount of information can be varied to make the task more difficult.

The most valid measures of higher level cognitive skills are those that use projects, simulations, or work situations that involve actual problems. These problems can be selected and modified to present various levels of difficulty. A rating scale should be used to evaluate performance and products that result from the problem-solving activities.

Figure 4: Valid Evaluation Techniques for the Cognitive Domain

Taxonomy Levels	Evaluation Techniques
6. Evaluation	• Project • Design Problem • Simulation • Actual Work Situation
5. Synthesis	• Interpretive Exercise • Project • Design Problem • Simulations • Actual Work Situation
4. Analysis	• Project • Design Problem • Problem Situation • Interpretive Exercise
3. Application	• Problem Assignment • Project • Interpretive Exercise
2. Comprehension	• Short Answer • Essay • M-C
1. Knowledge	• Short Answer Questions • Multiple Choice Tests • T-F • Matching • ETC

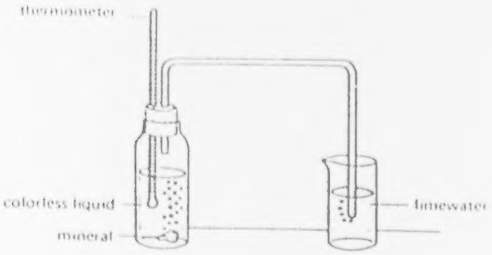
Figure 5: Interpretive Exercise

This question is based on the following situation.

A piece of mineral is placed in a bottle half filled with a colorless liquid. A two holed rubber stopper is then placed in the bottle. The system is then sealed by inserting a thermometer and connecting a glass tube to the stoppered bottle and a beaker of limewater as shown in the accompanying diagram.

The following series of observations is recorded:

I. Observations during the first few minutes:
   1. Bubbles of a colorless gas rise to the top of the stoppered bottle from the mineral.



   2. Bubbles of colorless gas begin to come out of the glass tube and rise to the surface of the limewater.
   3. The limewater remains colorless throughout this period of time.
   4. The thermometer reads 20° C.

II. Observations at the end of thirty minutes:
   1. Bubbles of colorless gas continue to rise in the stoppered bottle.
   2. The piece of mineral has become noticeably smaller.
   3. There is no apparent change in the level of the liquid in the bottle.
   4. The colorless liquid in the bottle remains colorless.
   5. The thermometer reads 24° C.
   6. The limewater is cloudy.

Which one of the following is the best explanation for the appearance of gas bubbles at the end of the tube in the beaker of limewater?

A The pressure exerted by the colorless liquid is greater than that exerted by the limewater.

[✓ B] The bubbles coming from the mineral cause an increased gas pressure in the stoppered bottle.

C The temperature increase at the end of thirty minutes causes an expansion of gas in the stoppered bottle.

D The decrease in the size of the piece of mineral causes reduced pressure in the stoppered bottle.

10. Educational Testing Service, *Multiple Choice Questions: A Close Look*, p. 15. Copyright © 1973 by Educational Testing Service (Princeton, N.J.). Used by permission of the publisher.

References

Bloom, Benjamin S., ed. (1956). Taxonomy of Educational Objectives-The Classification of Educational Goals, Handbook I: Cognitive Domain, New York: David McKay Co., Inc.

Gronlund, Norman E., (1985). Measurement and Evaluation in Teaching, Fifth Edition, New York: MacMillan Publishing Company.

Appendix D

Contact Letters

CVTAE
CENTER FOR VOCATIONAL, TECHNICAL AND ADULT EDUCATION
715-232-1382

UNIVERSITY OF WISCONSIN
STOUT
MENOMONIE WISCONSIN 54751

«DATA INST. SERV. ADMIN. ADDRESSES»

February 27, 1991

«name»
«school»
«address»

Dear «last name»:

The Wisconsin Board of Vocational, Technical and Adult Education and the Center for Vocational, Technical and Adult Education, University of Wisconsin-Stout are conducting a Problem-Solving Workshop on April 29, 30-May 1, 1991. The workshop will be held in the Student Center at UW-Stout.

The purpose of the workshop is to develop VTAE Occupational Instructors' capacity to teach problem-solving techniques used in business and industry. Currently we are surveying a sample of B/I in this region to determine the types of problem-solving techniques they use. The results from this survey will be used to establish the workshop agenda. Participants will learn how to use and apply the most common problem-solving techniques.

Districts should plan to send three occupational teachers to this workshop. A team will facilitate the application and implementation of the new concepts and strategies learned. Another team configuration would be two occupational teachers and a supervisor or curriculum specialist.

Credit Offered: One credit (either graduate or undergraduate) will be offered with tuition waived. A small UW-System institutional fee (graduate $11.10, undergraduate $14.10) will be the only charge. Registration for credit will occur at the workshop.

The workshop grant will cover lunches and breaks. Other meals, travel and lodging expenses are the responsibility of each VTAE district. There will be no general registration charge for this workshop.

Please complete the enclosed registration form and return it in the envelope provided by Wednesday, March 20, 1991. A confirmation letter will be sent to the teachers you identify on the enclosed registration form. This letter will include information on area motels and the workshop schedule.

We look forward to working with your teachers at the problem-solving workshop. If you have any questions, call us at (715) 232-1382.

Sincerely,

Orville Nelson	Steve Schlough
Co-Director	Workshop Coordinator
CVTAE/UW-Stout	CVTAE/UW-Stout
218 Applied Arts Bldg.	218 Applied Arts Bldg.
Menomonie, WI 54751	Menomonie, WI 54751

jb

Enclosure

UNIVERSITY OF WISCONSIN-STOUT IS AN EQUAL OPPORTUNITY AND AFFIRMATIVE ACTION UNIVERSITY

Registration Form

Problem-Solving Workshop
April 29, 30-May 1, 1991

VTAE District: ____________________ Date: ____________

Address: ____

Staff Member ____ Assignment in your District ____ Phone Number

1. ____________ ____________ ( ) ____________

Campus Address: ________________________________

____

2. ____________ ____________ ( ) ____________

Campus Address: ________________________________

____

3. ____________ ____________ ( ) ____________

Campus Address: ________________________________

____

Alternate

1. ____________ ____________ ( ) ____________

Campus Address: ________________________________

____

Thank you. **Please return in the enclosed envelope by Wednesday, March 20, 1991 to:**

Steve Schlough
Workshop Coordinator
CVTAE/UW-Stout
218 Applied Arts Building
Menomonie, WI 54751
(715) 232-1382

jb